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A.M.A. ARCHIVES OF OTOLARYNGOLOGY

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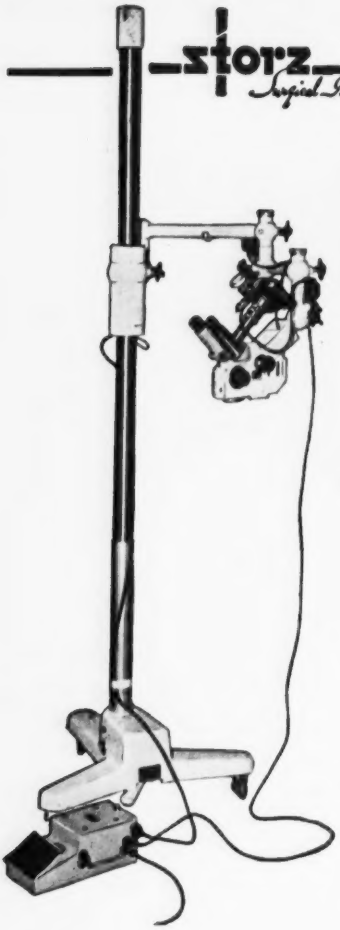

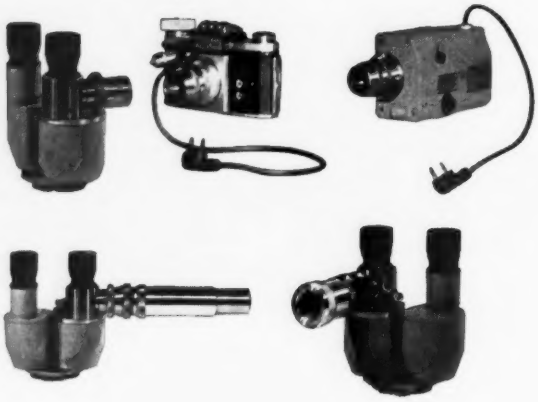

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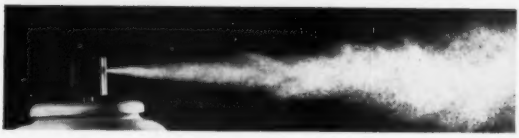
need  ...

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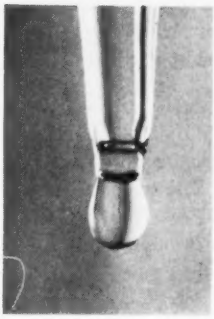

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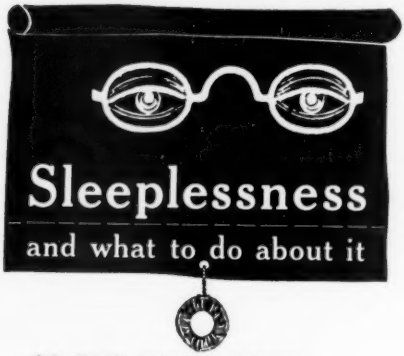

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Language Development Among Survivors of Premature Birth

SHULAMITH KASTEIN and EDMUND P. FOWLER Jr., M.D., New York

The development of language constitutes a major achievement and landmark in the general development of the young child.[1] Since language depends upon the structural, psychomotor as well as the intellectual and emotional integrity of the organism, the study of language development can serve as an additional differential diagnostic and prognostic tool in determining areas of dysfunction which may not otherwise be discernible at an early age.

Investigation into the causes of delayed or inadequate communication in the young child facilitates diagnosis since compensatory mechanisms and emotional overlays have often not yet developed. It also ensures habilitative measures at a time when they are most effective, that is, between 3 and 4 years of age. During this time, when language development is most directly dependent on sense perception, absent or defective functions of perception—body image, spatial orientation, and figure ground discrimination leading to symbol behavior—may be developed by training. This training will not only help the child to develop speech but will stimulate growth in other areas as well. If this is achieved, further deviation in functions, behavior, and emotional adjustment, which in turn may thwart the child's learning ability when he reaches school age, may be prevented.

Although it is true that overanxious parents often urge the pediatrician and other members of the professional team to "do something" about the child's supposedly delayed or defective speech, when it actually may be within normal range of development, it is equally true that in many instances early language and speech evaluation and therapy may prevent serious problems at a later age. Such evaluation is particularly important in children with "organicity," * that is, children who may show some deficit in the functions of the central nervous system.

Since new surgical procedures, new methods of management, and new drugs save more infant lives but without always preventing damage to their central nervous systems, the number of children with communication disorders is steadily increasing.

A large number of these children are born prematurely.

This paper is concerned with a research study of a group of premature children previously reported in a paper on "A Dif-

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From the Department of Otolaryngology and the Department of Pediatrics, Babies Hospital, College of Physicians and Surgeons, Columbia University.

Speech Pathologist, Speech and Hearing Clinic, Columbia-Presbyterian Medical Center (Mrs. Kastein); Executive Officer and Professor of Otolaryngology, College of Physicians and Surgeons, Columbia University (Dr. Fowler).

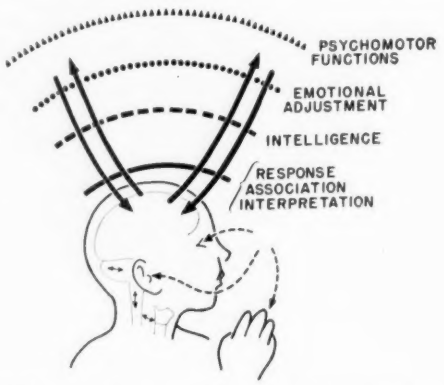
* The terms "organicity" and "organic" in this paper are used synonymously with "brain-injury" and "brain-injured" as defined by Strauss.[2]

ference in Mortality Rate and Incidence of Kernicterus among Premature Infants Allotted to Two Prophylactic Antibacterial Regimens."[3]

Follow-up studies of the survivors of the above-noted study included 66 of these children to determine deviations in development, carried out by a team of investigators who saw the children within two weeks of their second birthdays. Each child was seen once by each member of the team during visits scheduled for two days in the following order: psychometric, speech pathological and audiological evaluation on one morning; pediatric, dental, ophthalmological, neurological, and electroencephalographic studies during one day within the following week.

In order to evaluate language and speech development in the 2-year-old child, findings from a previous study on "Differential Diagnosis of Communication Disorders in Children Referred for Hearing Tests"[2] were considered, and the evaluation procedure and record form used in the study were modified to suit this investigation.

The assumption was made that in order to develop language the child needs sufficiently intact peripheral sense organs of hearing, sight, and touch to accurately perceive stimuli from the outside world. He further needs sufficiently intact cortical functions to interpret what he hears, sees, and feels and to comprehend and use symbols. After these symbols—be they auditory, visual, or tactile—have been perceived and interpreted, proper associations have to be made through past experience and learning in order to choose and execute the adequate response. To do this appropriately and within the proper span of time a certain degree of intelligence is essential. Moreover, since speech is a function of communication, the child must be sufficiently adjusted emotionally to want to communicate and live in a psychological climate conducive to communication. He must develop psychomotor functions which, on a cortical level, are responsible for his awareness of himself as an organism separate from the mother and the world around him. This means he must have a concept of his body (body image), orientation in space, visuomotor functions, and the ability to focus on the stimulus presented and to perceive it as a whole (gestalt) against the background of unstructured stimuli, be they in the field of hearing, vision or touch.[6] Verbal speech, in this hierarchy of functions, is in turn determined by the ability and desire to understand and use words as a means of communication. Narrowing the concept further, the final motor function depends upon the integrity of the mechanisms of phonation and articulation. That is, speech depends upon the coordination and rhythmic movements of muscles which have been used and developed by the infant for breathing, sucking, swallowing, and chewing. Articulate speech, therefore, is based upon a well-coordinated breathing mechanism to supply and control the flow of breath; adequate laryngeal structures as well as afferent and efferent functions to produce and control volume, pitch, and tone of voice adequately. There must also be adequate oral structures to direct the air stream and to serve as resonators as well as articulators. The articulation of both vowel and consonant sounds is based in turn on the degree of precision and speed with which the soft palate, the tongue, the lips, and the jaws can be moved and their movements coordinated to maintain rhythm, modulation, sequence, and blends of sounds in connected speech (Fig-



Schema of the organs and multiple functions involved in the process of communication.

ure). Of course, to do this the child must have heard and understood what he is trying to say.

In order to evaluate language in the 2-year-old child and to determine causative and contributory factors interfering with the normal development of functions of communication from a language differential point of view, it was necessary to cut across the entire developmental profile of the child. For the purpose of this study, the findings had to be recorded in concise form and were recorded on the form below.

PREMATURE CLINIC EVALUATION
LANGUAGE AND SPEECH EVALUATION AT AGE 2 YEARS

STUDY NO. Date
Examiner

Response to stimuli					
auditory	none	very limited	limited	good	excellent
visual	none	very limited	limited	good	excellent
tactile	none	very limited	limited	good	excellent
Symbol behavior:					
pictures	none	very limited	limited	good	excellent
words (sounds)	none	very limited	limited	good	excellent
movements	none	very limited	limited	good	excellent
Perception:					
spatial	none	very limited	limited	good	excellent
hand-eye coordination	none	very limited	limited	good	excellent
body identification	none	very limited	limited	good	excellent
preferred hand	right	left			
Comprehension of speech:					
words	none	very limited	limited	good	excellent
sentences	none	very limited	limited	good	excellent
Contacts:	none	very limited	limited	good	excellent
Communication:	none	gesture	pantomime		verbal

Remarks:

The evaluations were made without bias since no history was taken and no questions were asked of the mother. Nor was there any intercommunication among the members of the team until all the data had been recorded and submitted.

The behavior of the child, and as much as possible of the mother-child relationship, as well as the ability of the child to relate to the examiner, were observed. The child was then exposed to auditory, visual, and tactile stimulation—such as the sound of a bell, a music box and voice, including the mother's voice; light, objects, and pictures were used as visual stimuli; touch of various parts of the child's body as tactile stimulation; his responses to these stimuli were recorded in the predetermined gradation used throughout the study, as none, very limited, good, or excellent.

Symbol behavior was evaluated from the child's response to single, colored pictures of familiar objects, which he either named, pointed to, or identified with the corresponding object, and from his response to words and pantomime.

Functions of spatial orientation were investigated by observing the child's ability to place round, square, and triangular pieces of wood into the appropriate recesses (Binet Forms). Hand-eye coordination was tested by observing the manner in which he manipulated a pencil and tried to copy a circular scribble. These activities also indicated whether or not hand dominance had been established.

Pointing to parts of his body upon verbal request or imitation was considered indicative of the degree of awareness of his own body (body image).

Comprehension of speech both of single words and sentences as well as his use of speech were noted or else his specific means of communication, if any, recorded, such as sounds, jargon, gestures, or pantomime.

Remarks were made describing diagnostically significant behavior patterns such as hyperreaction to external stimuli, hyperactivity, restlessness, and motor disinhibition, if they were considered indicative of possible "organic" factors. Gait, balance, arm and hand movements, and coordination were observed, and the presence of strabismus, nystagmus, and drooling taken into consideration, as were structural deviations.

The final judgment of the degree of a child's language and speech development was made according to four major categories and three subcategories.

I. Severely retarded
Indicating that language and speech development was due to physical and mental retardation, organic or otherwise

II. 1. Retarded
Indicating retardation of language and speech development at the time of testing
2. Retarded-organic
Indicating retardation of language and speech development reflecting "organicity"

III. 1. Adequate
Indicating that language and speech development showed at least a good start
2. Adequate-organic
Indicating that, although language and speech development showed at least a good start, symptoms of "organicity" were observed pointing toward possible future difficulties

IV. 1. Advanced
Indicating language and speech development were advanced for the age
2. Advanced-organic
Indicating that, although language and speech development were advanced, symptoms of "organicity" were observed pointing toward possible future difficulties

The category "organic" was used when the language profile and/or the behavior pattern suggested a deficit in the central nervous system.

Tabulation of the Language Evaluation Records

	Oxytetracycline * (Terramycin)	Penicillin Sulfisoxazole * (Gantrisin)	Total	
Severely retarded	8	1	9	(2 with hearing, 1 with visual impairment)
Retarded	10	2	12	(2 with hearing impairment, 1 blind)
Retarded-organic	8	9	17	
Adequate	10	3	13	(1 with hearing impairment)
Adequate-organic	8	3	11	
Advanced	2	1	3	
Advanced-organic	1		1	
			66	

* These antibacterial regimens had been administered during the first 5 days of life.[3]

Of the 66 premature children evaluated, 31 were male and 35 were female. It is interesting to note that there were 13 twins in this group, 6 pairs and 1 single member.

Of the 66 premature children in this study, therefore, only 16 were considered entirely normal.

Collation of the data and comparison of findings of all members of the evaluating team showed an interesting relationship. The information supplied by the language and speech evaluation related well with the rest of the ground findings and will be discussed in detail in another publication.[4]

Thus it seems that the development of language functions in the young child is a sensitive indicator not only of the developmental profile but also of the presence of "organicity."

It is interesting that in these very young children both advanced development of language and speech in one group (advanced) and specific, differentiated dysfunctions in the other groups ("organic") could be observed. Thus, some of these 2-year-old children expressed themselves in complete sentences and could articulate all speech sounds. On the other hand, in some of the children judged "organic" by their language

profile, the following observations were made: restlessness, hyperactivity, motor dysinhibition, hyperdistractability by external stimuli or lack of attention to stimuli; low threshold of frustration, sudden drastic changes of mood; marked discrepancy between receptive (comprehension) and expressive (speech) functions; difficulty in naming, echolalia, and perseveration.

The findings in this study of a group of premature children evaluated at 24 months of age will be further substantiated or revised in a follow-up investigation at age 3 years and 5 years, respectively.

This preliminary report is presented because it furnished additional support of the conclusions drawn from a previous study on children with disorders of communication and confirms the validity of differential diagnostic language and speech evaluation in children even at the early age of 24 months.

Summary and Conclusion

This paper presents the findings of a study investigating the language and speech development in 66 survivors of premature birth at 2 years of age.

The organs and functions upon which language development depend are outlined and form the basis of a developmental profile, with particular emphasis on evidence of dysfunctions of the central nervous system.

Analysis of the data show that 37 of the 66 children had retarded development of language, with or without "organicity," while 13 of the children with adequate or advanced language development also showed signs of "organicity," that is, evidence of involvement of the central nervous system in their responses or behavior during the examination.

The data obtained through this study confirm the validity of language evaluation in young children and its use as an additional differential diagnostic tool to determine areas of dysfunction which may not otherwise be discernible at an early age.

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Permanence of Hearing Results Ten to Seventeen Years After Fenestration for Otosclerosis

Including Case Report of Closure of a Fenestra Seven and One-Half Years After Successful Fenestration

GEORGE A. HILLEMAN, M.D., Rochester, N. Y., and GEORGE E. SHAMBAUGH Jr., M.D., Chicago

It has been 20 years since Lempert [1] first employed one-stage fenestration of the horizontal semicircular canal for the relief of deafness caused by otosclerosis. With the current widespread employment of the new surgical modality of stapes mobilization it is opportune to review the permanence of fenestration results to aid in evaluating the newer procedure.

The purpose of this communication is to report the 10- to 17-year postoperative hearing results in 690 fenestration operations, including one patient whose successful fenestration closed after seven and one-half years of maintained practical hearing.

Previous Studies of Long-Term Results of Fenestration

Four previous studies of long-term hearing results of fenestration have been made. In March, 1951, Adin and Shambaugh [2] reported the hearing results 5 to 10 years after fenestration in 390 patients operated on between July, 1940, and July, 1945. They found that 70% of the operations had resulted in a significant hearing improvement that had been maintained; 20% had lost part of their initial gain but still had a significant improvement of 11 db. or more for the speech frequencies; 5% had lost all of their initial improvement, probably owing to closure of the fenestra, while 5% had not been significantly improved at any time. Most of the closures had occurred in the cases operated on during the first several years, only 1 case of the 151 ears operated on since July, 1943, having lost all of its gain, owing, presumably, to closure of the fenestra.

Of the 390 cases tested 5 to 10 years after operation 29% were at the 30 db. practical level at the most recent test. This included all cases, whether of A, B, or C suitability. Considering the cases of A suitability alone, 44% were at the 30 db. practical level at the most recent test, 5 to 10 years after surgery, and could be considered fully successful.

Later in the same year House [3] reported the results in 200 fenestrations done five years previously. In replies to a questionnaire, 56% were able to dispense with a hearing aid five years after operation. Of 88 cases that had returned for an audiogram five years postoperatively 34% had less than a 30 db. loss for the speech frequencies.

That same year Hall [4] reported 71% successful results in 150 cases three and a half years after employing a cartilaginous stopple, and 82% successes two to three years after operation when no stopple was used. He did not specify the audiometric criteria used to define a success.

In 1954 Campbell [5] reported 200 cases five years or longer after operation, with 65% at, or better than, the practical 30 db. level in the most recent hearing test, with an average loss of 27.6 db.

Results Ten Years or More After Fenestration

For the present study 1,743 fenestration operations performed between August, 1939,

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Fellow in Fenestration Surgery at Northwestern University, 1957 (Dr. Hilleman).

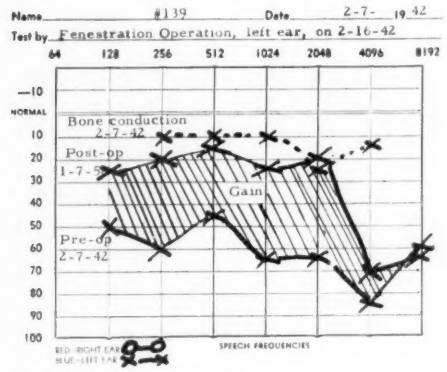

Fig. 1.—Example of successful result with hearing at 20 db. level for speech frequencies 16 years after fenestration; 43% of all fenestrations and 56% of A cases were in this category of success.

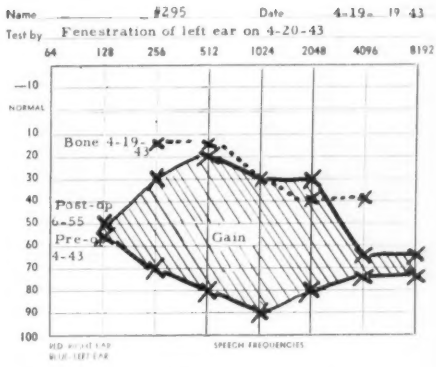

Fig. 2.—Successful result in a Class C case with hearing at 27 db. level for the speech frequencies after 12 years; only 8% of C cases were in this category.

and January, 1948, were reviewed. These dates were chosen because they included patients who had returned 10 years or more after operation for a hearing test. The fenestration technique employed during these years represented a progressive evolution[6] from the original Lempert technique to the improved technique[7] described in 1946. This technique, which has continued to be employed with few changes from 1946 to the present time, includes enchondralization, continuous irrigation, and the use of the operating microscope for constructing the fenestra, with particular attention to factors that influence osteogenesis as revealed by experimental studies.[8]

Of the 1,743 cases, 690, or 40%, returned for audiograms 10 or more years after sur-

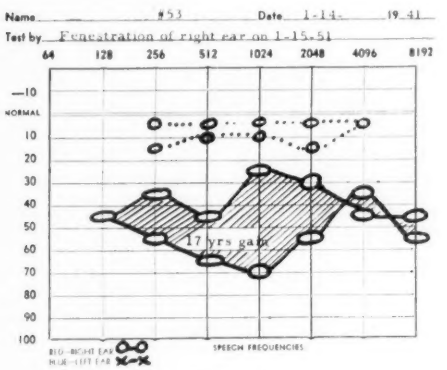

Figure 3

Fig. 3.—Significant improvement 17 years postoperatively; 86% of cases showed significant improvement.

Fig. 4.—Significant improvement two years after operation with subsequent loss due to nerve degeneration; 8% of all fenestrations lost their improvement, 35% of these being due to nerve degeneration.

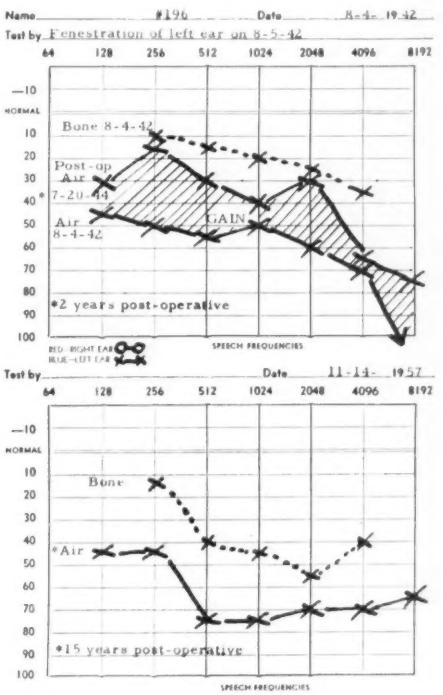

Figure 4

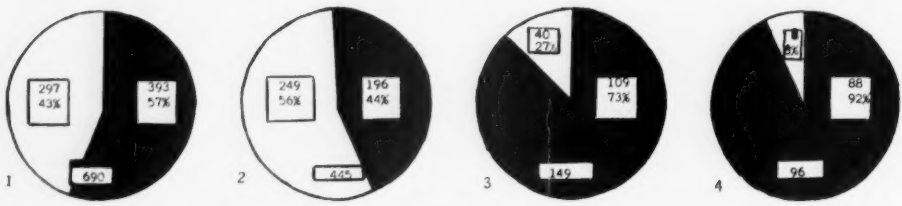

Chart 1.—Results in terms of "success" or "failure" at the most recent test taken 10 to 17 years postoperatively, success being defined as hearing at the 30 db. level or better for the speech frequencies. White area represents "successful cases." 1. Total cases. 2. Class A cases. 3. Class B cases. 4. Class C cases.

gery, the shortest interval being 10 years and the longest being 17 years and 10 months. As in previous studies, a 30 db. level of "practical" hearing in the most recent audiogram is considered a "successful" result (Figs. 1 and 2), and an average level of 31 db. or more for the speech frequencies is an "unsuccessful" result. Cases that have a gain of 11 db. or more for the speech frequencies are considered to have a "significant improvement" (Fig. 3); those with a loss of 11 db. or more have a "significant loss," while those with hearing within 10 db. of the preoperative level are considered to be "unchanged by surgery."

Chart 1 shows the number and percentage of successful and unsuccessful results in the series of 690 cases as a whole, and when divided into categories of "A", "B", and "C" suitability, "A" being those with normal preoperative cochlear function for the speech frequencies, "B" those with one of the speech frequencies impaired below the normal range as judged by the bone curve after correction for the Carhart otosclerotic notch, and "C" those with two or all three of the speech frequencies impaired by bone.

Chart 2 shows the 10- to 17-year postoperative results in terms of significant im-

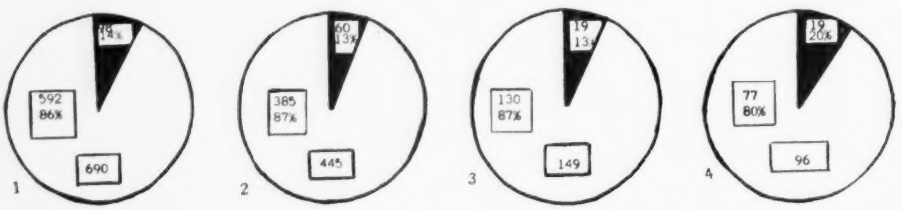

Chart 2.—Results in terms of significant improvement at 10 to 17 years postoperatively, significant improvement being defined as a gain of 11 db. or more for the speech frequencies. White area represents significant improvement. 1. Total cases. 2. Class A cases. 3. Class B cases. 4. Class C cases.

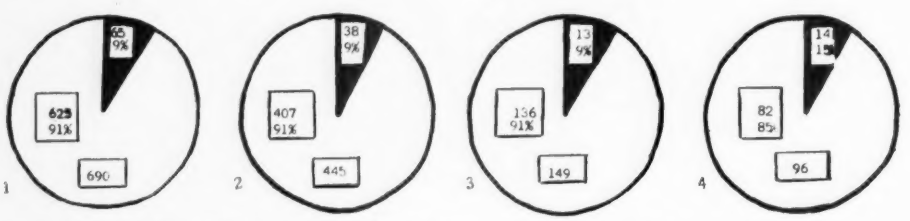

Chart 3.—Results in terms of significant improvement at one year postoperatively. Compare with Chart 2. White area represents significant improvement. 1. Total cases. 2. Class A cases. 3. Class B cases. 4. Class C cases.

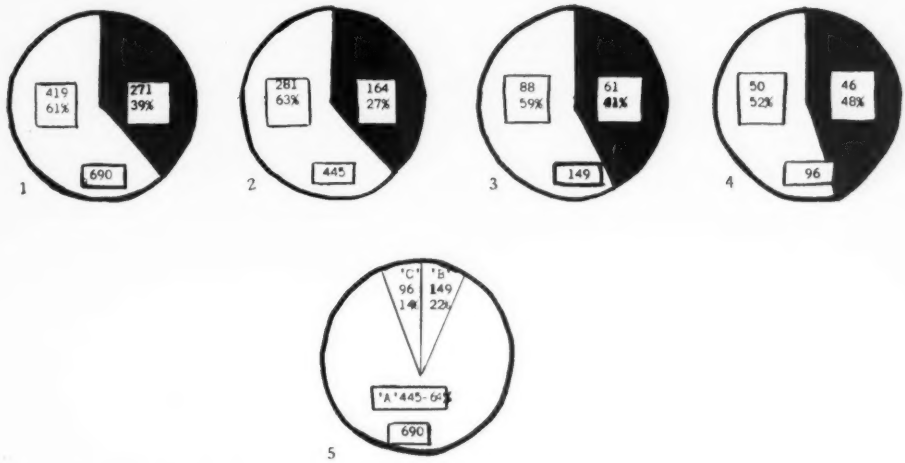

Chart 4.—Results in terms of improvement maintained to within 10 db. of the best level for the speech frequencies, 10 to 17 years postoperatively. White area represents improvement maintained. 1. Total cases. 2. Class A cases. 3. Class B cases. 4. Class C cases. 5. Distribution of cases.

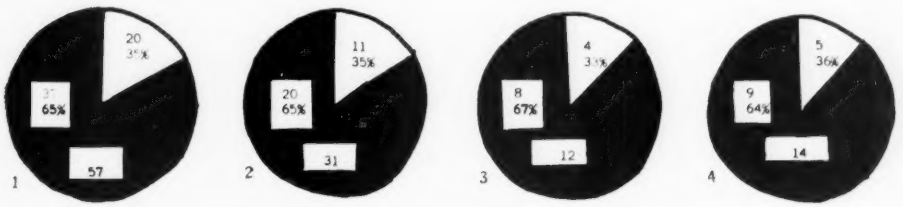

Chart 5.—Analysis of the 57 cases showing a loss of all initial improvement to with 10 db. of the preoperative level. Black area represents probable closures. White area represents cochlear nerve degeneration. 1. Total cases. 2. Class A Cases. 3. Class B cases. 4. Class C cases.

provement or loss, rather than 30 db. success, in the group as a whole, and broken down into A, B, and C suitability. Chart 3 shows the same data at one year after operation, for comparison.

Of the 690 ears operated on, 419 received a significant improvement in hearing that was maintained within 10 db. of its best level at the time of the last test. In other words, in 419 cases, or 61% of the operations, there was not a significant decline in the hearing level during the passage of 10 to 17 years (Chart 4). In 178 cases, or 26% of the operations, there was a partial loss of the hearing gain of more than 10 db. but not to within 10 db. of the preoperative level, while in 57 cases, or 8%, there was a loss of all of the improvement to within 10 db. of the preoperative hearing. Especial attention was directed toward the last group of cases to determine the probable cause for the loss of improvement, with these results:

In 20 cases the decline in hearing occurred in the higher frequencies, with a similar decline in the bone-conduction audiogram, indicating cochlear nerve deterioration as the probable cause for the loss of improvement (Chart 5; Fig. 4).

In 37 cases the hearing declined gradually for all frequencies, reaching the preoperative level within two years of surgery in nearly all cases (Table). These were considered to be probable closures of the

Breakdown of Hearing Results in 690 Cases Tested Ten to Seventeen Years After Fenestration

Class	Total	Significant Improvement Maintained to Within 10 Db. of Best Level	Partial Loss of Gain of More than 10 Db. but not to Within 10 Db. of Preop. Level	Loss of All of Improvement to Within 10 Db. of Preop. Level *	Hearing Level Unchanged by Surgery † (±10 Db. of Preop. Level)	Hearing Worse, −11 Db.
A	445	281 (63%)	108 (24%)	29 (7%)	13 (3%)	14 (3%)
B	149	88 (59%)	42 (28%)	14 (10%)	3 (2%)	2 (1%)
C	96	50 (52%)	28 (29%)	14 (15%)	3 (3%)	1 (1%)
Total = 690		419 (61%)	178 (26%)	57 (8%)	19 (3%)	17 (2%)

* Two-thirds are closures, one third cochlear degeneration. See Chart 5.
† +10 db. of preoperative level.

fenestra. Revision was performed in one patient, this case being reported below.

Particular interest attaches to cases whose fenestras closed later than two years after operation. One such case [9] was reported in 1949, where the hearing began to decline between two and three years after operation, reaching the preoperative level in the four-year postoperative test. At revision the fenestra was found to be closed.

A second case was encountered in the current study where an excellent hearing improvement to the practical level was maintained for seven and a half years, followed by closure of the fenestra:

Report of Case

A young woman was first seen at the age of 35 by Dr. George Shambaugh, Sr., on May 28, 1927. The complaint was of a bilateral hearing impairment of 10 years' duration, beginning insidiously and progressing slowly. There was no history of previous otitis media and no family history of impaired hearing. An audiogram showed an average loss for the speech frequencies of 38 db. in the right ear and 48 db. in the left ear. The tympanic membranes were normal, and the Rinne test with the 128 tuning fork was strongly negative in both ears. The diagnosis was made of primary stapes fixation due to otosclerosis. No treatment was advised.

In 1929 the patient returned, complaining of increased difficulty in hearing. She now had a 47 db. loss in the right ear and a 43 db. loss in the left ear.

In June, 1940, she returned again, and now had a 47 db. loss in both ears (Fig. 5A). A fenestration of the left ear was performed on July 24, 1940, improving the hearing to the practical level. Three years later, in September, 1943, the right ear was fenestrated, and this, too, resulted in a practical level of hearing (Fig. 5B).

This patient returned at regular and frequent intervals of once to several times yearly to have the fenestrated cavities cleaned and the hearing tested. Except for the minor fluctuations within a narrow range of less than 10 db. observed in any

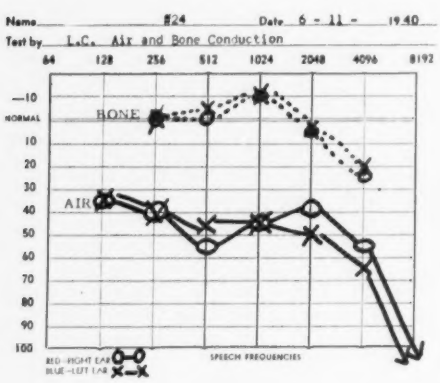

Fig. 5A.—Preoperative audiogram.

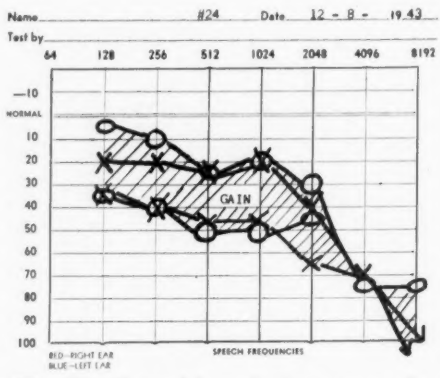

Fig. 5B.—Successful result three years after fenestration of left ear; three months after fenestration of right ear.

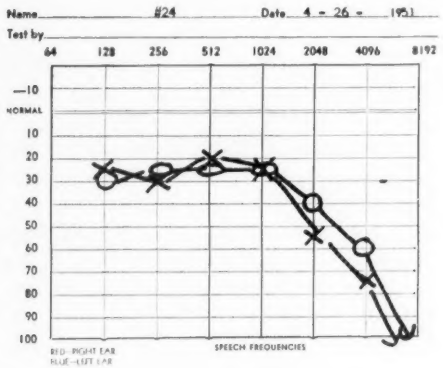

Fig. 5C.—Maintained improvement after seven and one-half years in right ear, 11 years in left ear.

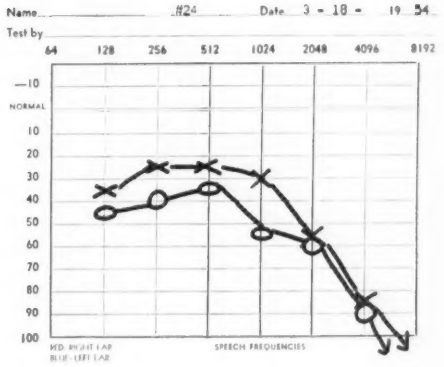

Fig. 5D.—Partial closure of right ear which began eight and one-half years after successful result.

patient over a period of time, the hearing remained stable (Fig. 5C) through April, 1951. In March, 1952, 8½ years after the fenestration of her right ear and 11 years after fenestration of her left ear, she returned, noting that the hearing in the right ear was beginning to decline (Fig. 5D). The decline continued, until by March, 1954, 10½ years after fenestration of this ear, the hearing had returned to its preoperative level (Fig. 5E). The opposite left ear, operated on 13½ years earlier, meanwhile remained at the practical level.

Because it is so very unusual to observe closure of a fenestra later than two years postoperatively, this patient was placed on a low-salt diet with injections of dilute histamine and later on nicotinic acid by mouth, on the possibility that the loss of hearing might be the result of an atypical labyrinthine hydrops. The hearing did not improve. Despite the still moderately positive fistula test, the diagnosis was made of a probable closure of the fenestra.

Revision of the right ear was performed on July 11, 1955, 12 years after the original fenestration. When the skin and periosteum were elevated from the bony horizontal semicircular canal, the outlines of the original fenestra were clearly seen, but the opening was covered by a thin layer of bone over the posterior third and by a thin layer of dense fibrous tissue over its anterior two-thirds. The endochondral bone of the capsule around the fenestra widely exposed at the original operation had become covered by a thin layer of periosteal bone.

The lid of fibrous tissue and bone covering the fenestra was freed from the margins by freshly enchondralizing the surrounding bone. The freed lid was then gently elevated under the operating microscope and carefully dissected away from the underlying endolymphatic labyrinth to which it was adherent, without tearing the latter. The skin flap was replaced with the usual elastic sponge packing, and the ear was entirely healed and dry six weeks

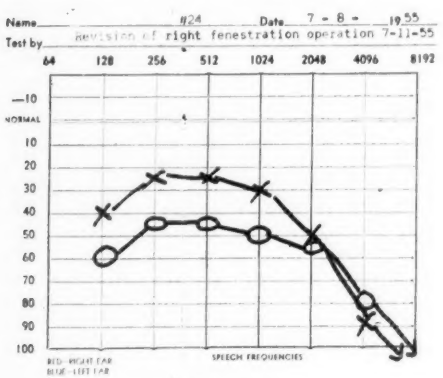
Name #24 Date 7 - 8 - 19 55
Test by revision of right fenestration operation 7-11-55
64 128 256 512 1024 2048 4096 8192
—10
NORMAL
10 20 30 40 50 60 70 80 90 100
RED - RIGHT EAR
BLUE - LEFT EAR
SPEECH FREQUENCIES

Fig. 5E.—Right ear closed before revision.

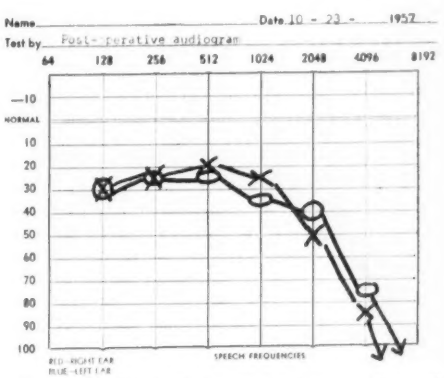
Name Date 10 - 23 - 1957
Test by Post - ferative audiogram
64 128 256 512 1024 2048 4096 8192
—10
NORMAL
10 20 30 40 50 60 70 80 90 100
RED - RIGHT EAR
BLUE - LEFT EAR
SPEECH FREQUENCIES

Fig. 5F.—Result 2½ years after revision of fenestration of right ear, 17 years after fenestration of left ear.

later. The hearing was again improved to the practical level, where it has remained for the two and a half years since revision (Fig. 5F). The hearing level in the opposite ear is still at the practical level, now nearly 18 years after fenestration.

Comment

In this long-term study of results in 690 fenestrations followed for 10 to 17 years after operation, when the results are tabulated solely with regard to the final level of hearing at the most recent test, 43% have remained at the 30 db. level and are considered successful, while 57% have a loss of 31 db. or more for the speech frequencies and are considered failures (Chart 1). The percentage of successes is higher (56%) in the cases of A suitability, than in those of B suitability (27%) and of C suitability (8%) as would be expected.

This study confirms the general tendency toward stabilization and maintenance of maximum improvement in the ear operated on in the majority (61%) of cases of fenestration followed for 10 to 17 years after surgery (Chart 4). In 26% there is a partial loss of the maximum improvement, in 8% loss of all of the improvement, while in 3% the operation failed to improve the hearing, and in 2% the hearing became worse.

Of the 8% of cases that have lost all of their improvement over the years 35% were the result of neurosensory deterioration, while 65% were probably the result of closure of the fenestra by bone and fibrous tissue (Chart 5), or an over-all percentage of 5% of closures.

This study emphasizes the rarity of fenestral closure later than two years postoperatively, only 2 such cases being encountered in 690 operations followed for 10 to 17 years. The dependability and permanence of the hearing improvement in the majority of fenestration operations performed by modern techniques is noteworthy. The observation that comparatively few cases (20 out of 690, or 2%) lost all of their gain, owing to progressive neurosensory deterioration, is surprising in view of the underlying otosclerotic lesion which presumably is not affected by this operation. In another study directed toward hearing changes in the untreated ear this aspect of otosclerosis is being investigated.

In a total experience of more than 4,300 fenestration operations performed by us and our associates during the past 20 years, only 2 cases of proved closure of the fenestra occurred later than two years after operation—one previously reported that closed between the third and fourth year, and this case that closed between seven and nine years after operation.

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Histopathology of Olfactorius Due to Sarcomatosis of the Meninges

A Study with Silver Carbonate

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The olfactory bulb is exceptionally suited for studies of various pathological processes affecting the nervous system. This is due to the fact that in the bulb is located a complicated system of synapsis between the sensory cells and the second neuron. The complex functions require a support of the glial elements which are highly differentiated and are specific for the different layers.[1] The present study is concerned with the cellular response to a slowly increasing pressure due to meningeal infiltration by a metastatic tumor. The importance of the findings is increased by the fact that the damage caused by pressure is slow and there is no infiltration of the tissues which would complicate the understanding of the pathological picture.

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From the Laboratory of Neuropathology, Department of Psychiatry, University of Michigan Medical School.

Material and Methods

The tissue for the present study was obtained on a postmortem examination of a 6-year-old girl with a sarcoma of the meninges of the spinal cord. This sarcoma eventually spread over the cerebral meninges and caused "hypertrophy" of all the cranial nerves without infiltration of the parenchyma. The grossly enlarged olfactory bulbs and tracts were carefully separated from the thick firm meninges, fixed in formalin-bromide, and frozen sections 15μ thick were impregnated with the silver carbonate technique of del Rio Hortega[2] as described by Scharenberg and Zeman.[3] All

Fig. 1.—Olfactory bulb with meninges infiltrated by the neoplasm. Zeiss Periplan 2.5 ×.

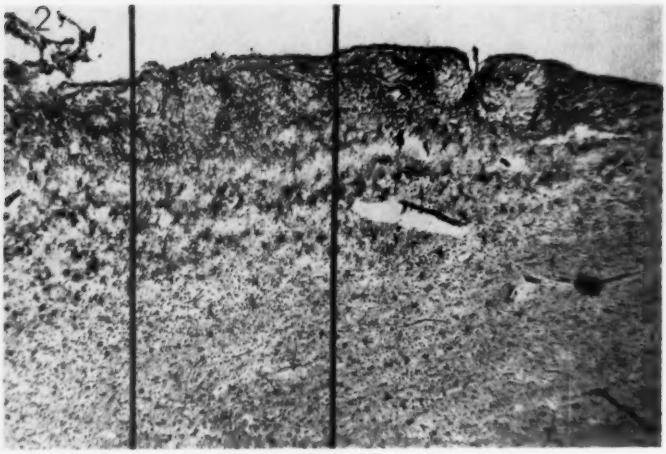

Fig. 2.—Olfactory bulb. The layers with different glial reactions can be distinguished. Zeiss Periplan 2.5 ×.

the illustrations are unretouched photomicrographs.

Description of the Material

The olfactory bulb is approximately twice the normal size, and the parts of the meninges which are infiltrated by the tumor are adherent to the surface of the bulb (Fig. 1).

The glomerular layer can be well recognized in this picture, mostly because the interglomerular glial tissue is markedly proliferated. The proliferation of the glial elements throughout the bulb can be seen at low magnification (Fig. 2). Figure 3 represents a composite picture of a segment shown in Figure 2. The surface of the bulb is filled with debris of broken-down astroglial elements, swollen oligodendroglia, and occasional gitter cells (Fig. 4). There was no indication of any fibers of the fila olfactoria left intact. The glomeruli show very pronounced astroglial reaction; the proliferated cells with numerous powerful processes encapsulate the glomeruli (Fig. 5). Other astroglial cells invade the center portion of the glomeruli and fill them with long branching processes (Fig. 6).

The ganglionic layer also shows signs of severe damage. The nerve elements are degenerated and only some of them are still recognizable. The astro- and oligodendroglial reaction is very pronounced in this layer; the cell bodies of the astrocytes are enlarged; their slender processes are increased in number (Fig. 7).

The severity of damage decreases with distance from the surface of the bulb. The line of demarcation between the severely and slightly degenerated areas can be found central to the mitral cells, where increasing numbers of nerve fibers run perpendicularly to the central portion of the bulb to join the layer of the olfactory tract fibers (Fig. 8). The astrocytes in this area are different from the ones close to the surface because their bodies are slender and the long and thin processes are running parallel to the nerve fibers.

In the remainder of the ganglionic layer, which normally is occupied by tufted ganglion cells, some mitral cells, and small neurons, became in this case markedly enlarged (Fig. 3). The astroglia reaction can be followed throughout this layer, and there is also evident a numerical increase of oligodendroglial elements toward the layer of the olfactory tract fibers. With the increase in number of normal oligodendrocytes, the appearance of the astroglia changes gradually from elements which have large bodies and numerous processes with pearl-like swellings (Fig. 9) to elements with small bodies and long, fine processes; final-

Fig. 3.—Composite picture representing the same area as in Figure 2. Zeiss Neofluar 16×.

ly, close to the layer of olfactory tract fibers the amount of astroglia is reduced and shows almost no evidence of pathological changes (Fig. 10).

In the nerve fiber layer the astroglial and oligodendroglial elements are numerous and their appearance differs slightly from normal; the processes are somewhat thickened but very long and follow the parallel course with the nerve fibers (Fig. 11).

Comment

The changes of the olfactory bulb were produced by a chronic increase of pressure by meningeal sarcomatosis. To atribute all the changes to pressure alone may be an

Fig. 4.—Surface of the bulb with astrocytes, oligo- and microglia. Zeiss Neofluar 100×.

Fig. 5.—Large forms of astrocytes which form a capsule around degenerated glomerulus. Zeiss Neofluar 100×.

Fig. 6.—Astrocyte with branching processes in the glomerulus. Zeiss Neofluar 100 ×.

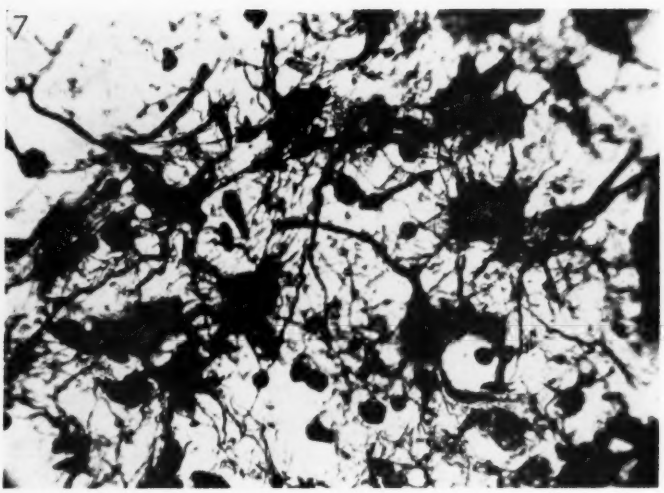

Fig. 7. — Glomerular layer.—Degenerated neurons and proliferated astrocytes. Zeiss Neofluar 100 ×.

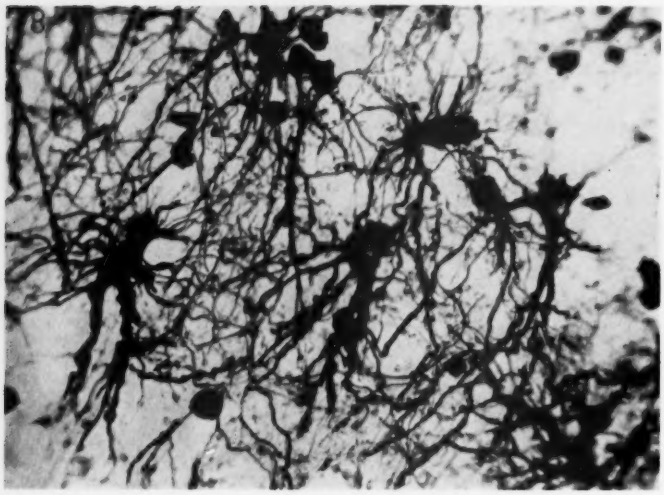

Fig. 8.—Astrocytes. The processes accompany the neurites from the ganglionic to the nerve fibers layer. Zeiss Neofluar 100 ×.

oversimplification of the problem, but they do dominate the picture. The layer of the fila olfactoria is completely destroyed. This is partly caused by destruction of the fila olfactoria between the cribriform plate and the bulb. The importance of the fact that the afferent fibers of the first neuron have been destroyed and that the changes should be attributed to secondary degeneration only can be disregarded, since the picture described by the degeneration due to separation of the olfactory bulb from the first neuron differs completely from the one found in the present case.[4] The pressure necrosis of the surface produced the histological picture of infiltration by gitter cells and swollen oligodendroglia; the astroglial elements are severely damaged and only debris of their cell bodies and processes are left. The second (glomerular) layer is also severely damaged, but the picture of active degeneration is overshadowed by the process of advanced repair. This is visible in the proliferation of the astroglia, which sometimes assumes gigantic forms, encapsulates and penetrates the destroyed, nonfunction-

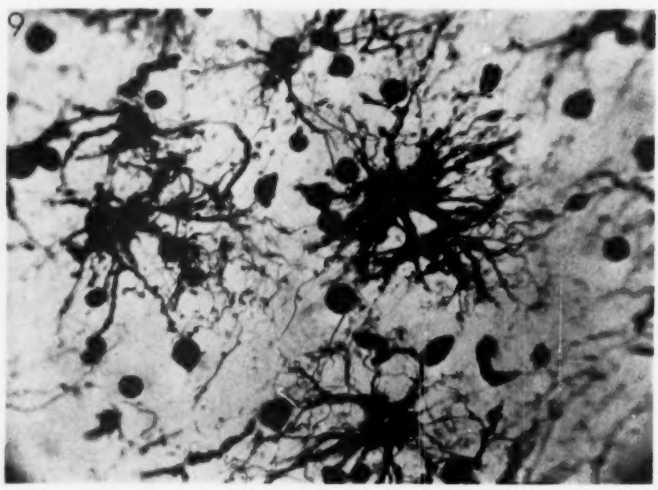

Fig. 9.—Astroglia from the ganglionic layer. Numerous processes show pearl-like swellings. Zeiss Neofluar 100 ×.

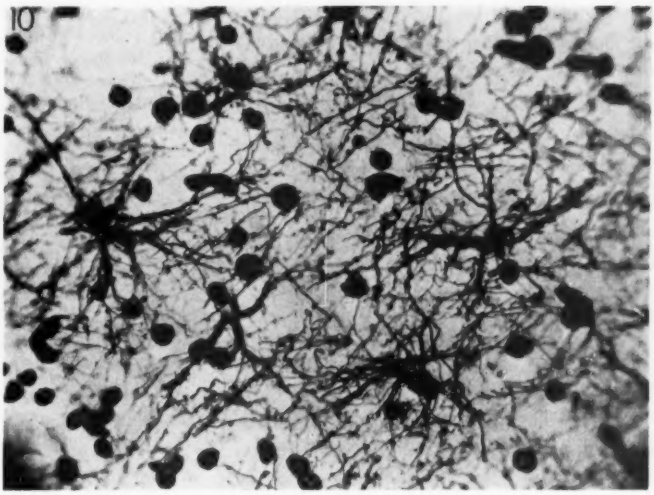

Fig. 10.—Astroglia from the transitional area between the ganglionic layer and the layer of olfactory tract fibers. Zeiss Neofluar 100 ×.

ing glomeruli; subsequently a solid scar is formed.

The degeneration of the ganglionic layer can be divided into two parts: 1. The external portion in which mainly mitral cells are located and which is the most severely damaged. The neurites arising in these ganglion cells are perpendicular in their course and accompanied by astroglia with numerous long processes. 2. The internal portion of the ganglionic layer, which normally contains numerous tufted cells, some mitral cells, and various small ganglionic elements, shows little damage toward the central portion of the bulb. The layer of the olfactory tract fibers is also thickened but shows the least amount of pathological change.[5]

Summary

Chronic pressure produced by meaningeal sarcomatosis produced enlargement of the olfactory bulb with proliferation of the cellular elements. The most extensive damage

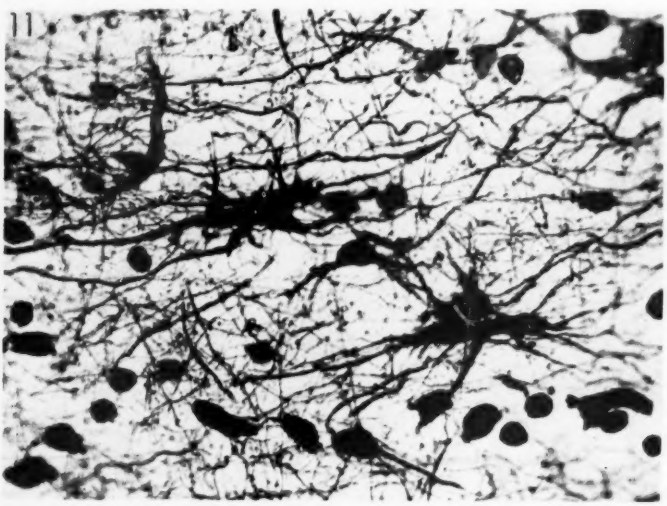

Fig. 11.—Astroglia from the layer of olfactory tract fibers. Zeiss Neofluar 100 ×.

can be observed on the ventral surface of the bulb; damage becomes less extensive in the central portion.

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Management of Dysphagia Due to Retained Meat in the Esophagus

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In the past four years four cases of dysphagia caused by lodging of large particles in the esophagus have been encountered. Another case with a fatal outcome, due to complications of the treatment used, was observed in this hospital and deserves comment. Since this entity is not a well-known one, and since there are simple harmless methods of treatment, it was deemed appropriate to record our observations.

The cases were primarily, but not invariably, in elderly patients with edentia or dentures. Onset of symptoms was usually noted immediately while eating some form of meat. In this group of patients, roast beef, chicken, turkey, and "hot dogs" were the offending agents. The patients noted onset of choking, chest pain, or dysphagia immediately on swallowing the meat, which apparently became lodged in the esophagus. In the four patients personally managed, two of the patients thought they had swallowed too big a piece of meat without having masticated it well. The other two patients did not believe they had swallowed a larger piece of meat than usual.

In all cases, the patients pointed to the area of the supraclavicular notch as the location of what they felt was an obstruction. Liquids were taken by all to attempt to relieve the obstruction, without effect. In two of the cases, fluid was regurgitated. The four patients were referred for esophagoscopy one to three days after the acute episode, and none was able to swallow solids. In two cases, after the first day, liquids could be taken.

In the four cases barium swallow was done and x-rays of the esophagus were taken. In only one case was a definite, but small, filling defect noted at the level of the third dorsal spine. In one patient a questionable lesion was noted at the level of the second dorsal vertebra. In the two other cases the x-rays were negative. No intrinsic esophageal disease was noted in any of the x-ray films.

In the first three cases, esophagoscopy, using the Eder-Hufford esophagoscope with a flexible obturator, was performed. In no case was the meat particle seen, but in each case relief of symptoms was noted immediately after esophagoscopy. The relief was permanent in each case. These three cases are briefly reported:

CASE 1.—A 68-year-old white man noted onset of choking while eating roast beef. He swallowed water immediately with discomfort. He was not able to eat anything because attempts to do so resulted in dysphagia. The next day he noted upper chest pain on attempting to take fluids and was seen by me two days after the acute episode. The patient used dentures for many years. Physical examination revealed no pertinent abnormality. Chest x-ray and esophagram were not remarkable. Esophagoscopy was performed, but no lesion was noted. However, immediately after the procedure the patient stated he was cured. An hour later, allowing time for the topical anesthesia (tetracaine [Pontocaine] gargle) to wear off, he was able to take water and solid food with no trouble. He reported daily for a week thereafter, with no recurrence of symptoms. He was seen six months later and was quite well.

CASE 2.—A 71-year-old white woman noted pain in the lower part of the neck while eating turkey. This discomfort was followed by regurgitation of anything she attempted to eat. Pain was noted

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on swallowing. She had worn dentures for years. After three days, she was seen by me. Her doctor had obtained an esophagram which showed a small defect at the level of the third dorsal vertebrae. Esophagoscopy was performed with ease. No abnormality was noted except a small area of hyperemia in the upper third of the esophagus. She felt better immediately after esophagoscopy was performed. No dysphagia was noted on drinking water an hour later. There was no return of symptoms in the next week. At six months there had been no recurrence.

CASE 3.—A 59-year-old white man encountered choking and regurgitation while eating fried chicken. He thought he had swallowed a large piece of chicken. The patient had his own teeth. Since symptoms continued, an esophagram was done and was reported to be normal. Esophagoscopy was done about 26 hours after the acute episode. No abnormality was seen. An hour after esophagoscopy he was able to drink and eat without difficulty. There was no recurrence after six months.

Because of the similarity of immediate disappearance of symptoms after esophagoscopy, in spite of negative findings, it was thought that the meat particle in each instance had been dislodged by the preliminary passage of the obturator into the upper esophagus. Apparently the reason for not seeing the meat particles is that they passed down the esophagus into the stomach. Probably the particles were not excessively large. Although x-ray and esophagoscopic findings in two of these cases afforded no objective evidence of the presence of the obstructing food, the history of sudden onset of symptoms while eating and persistence of these symptoms until the described treatment make it likely that impaction of food was the causative factor. Why such objects get stuck in the upper part of the esophagus is not clear. In only one case was there slight evidence of esophagitis, and it is postulated that this was secondary to the retained meat.

The accomplishment of relief of symptoms seemed due to passage of the obturator. Esophagoscopy itself was not considered essential. Thus, I believe that the same thing could be accomplished by passage of a rubber tube of adequate size. When the next case was encountered, this was done with results equally good.

CASE 4.—A 67-year-old white woman was referred to me because of dysphagia of three days. This came on immediately while eating roast beef. She had an upper denture. Next day an esophagram revealed a dubious filling defect at the level of the second dorsal vertebrae. Physical examination revealed no pertinent abnormality. After tetracaine gargle, a Size 30 F. rubber tube was passed into the stomach and met no obstruction. The tube was partially withdrawn and then again passed into the stomach. The tube was then withdrawn. Two hours later the patient was able to swallow liquid and soft food. Bismuth subcarbonate powder, taken in teaspoonful dose with sips of water directly before eating, was prescribed. The next day the patient reported she was well, and at the end of two weeks there had been no recurrence of symptoms.

Comment

It seems quite obvious that for the dislodgement of meat and probably also for vegetable substances in the esophagus passage of a large rubber tube will be adequate treatment. The use of bismuth subcarbonate for an accompanying esophagitis is probably advisable for several days, though esophagoscopic findings have not shown esophagitis to any notable degree in these cases. If constant relief of symptoms is not forthcoming in a day or two after passage of the rubber tube, esophagoscopy should be done. In any event, a preliminary esophagram should be obtained prior to passage of the rubber tube, though it may not be considered essential and in our cases was not too helpful. Intrinsic esophageal pathology such as diverticula or stricture may be revealed.

It is to be clearly understood that this method of management is not advocated for metallic objects in the esophagus or for fish or animal bones, since it is conceivable that such objects may be caused to further penetrate the mucosa and even the periesophageal structures by passage of a rubber tube. In most cases, the esophageal x-rays will detect foreign bodies of this nature, in which case esophagoscopy with direct removal is in order. However, such treatment is not believed advisable in the type of cases here reported, in view of the dangers involved, as will be demonstrated below, and

in view of the ease of the advocated treatment. The simplicity of this method commends itself when used only for dislodgement from the esophagus of vegetable and animal particles.

Furthermore, prior to passage of the tube, evidences of avitaminosis should be sought for, since elderly women who use dentures may lack adequate diet with proper vitamins. Some observers believe that avitaminoses may affect the esophageal wall and make it more susceptible to rupture. Another precaution is that occasionally the swallowed meat may contain a portion of a sharp bone. In such cases, even passage of a rubber tube should be done with careful preparation.

Why such particles lodge in the esophagus to give rise to dysphagia and regurgitation is not simply explainable in view of the absence of intrinsic esophageal disease, such as diverticula, stricture, or esophagitis in the upper half of the esophagus, where the enlodgement apparently is more apt to occur. The most logical explanation seems to be that the size of the insufficiently masticated food is too large for the esophageal passage. That the presence of narrowing of the esophagus in this area by encroachment from the outside of an enlarged aorta or other mediastinal structures may also be a factor initiating the trapping of particles of meat is also to be considered, but an answer is not available on the basis of observations in these cases.

Richardson [1] reported the use of papain, or vegetable pepsin, which acts in acid, neutral, or alkaline media and digests about 35 times its own weight of lean meat, in the treatment of esophageal obstruction due to meat impaction. His report of 17 cases is interesting and one of the most complete reports that I have been able to find in the literature. In 11 of the cases there were known strictures of the esophagus and the meat impaction occurred above the strictured area. However, in six of the cases the esophagus was quite normal on x-ray examination and there was no history of previous esophageal difficulty. These six cases were similar to the ones reported in the present paper. All of the patients were women, with the ages ranging from 44 to 75. The location of each obstruction was noted to be high in the esophagus, and this is exactly what was found in the cases presently reported. All of the patients wore dentures, and the offending agents were steak, lamb, and pork. An artificial upper denture seemed to be the chief etiologic factor in obstruction of the esophagus by meat. The author offered no explanation for the location of the obstruction in the upper end of the esophagus. In these six cases the use of papain resulted in relief of symptoms from one-half to seven and a half hours after the administration of periodic doses of the papain. This also appears to be a perfectly safe method and probably should be used in instances where mere passage of a rubber tube, as advocated above, does not cause immediate relief of symptoms.

That on occasion, probably rare, direct removal may be dangerous and even fatal is illustrated by the following case report:

CASE 5.—A 34-year-old white man was transferred to the Renal Service of this hospital from another hospital for possible dialysis by an artificial kidney for treatment of acute renal insufficiency. A week previously, while eating a "hot dog," the patient started choking. He could not eat or drink anything without pain and regurgitation. After admission to another hospital, he was esophagoscoped and attempt to remove a piece of the "hot dog" in the midesophagus was not completely successful. He was, therefore, esophagoscoped again on the next day, and it was felt that the food particle was now completely removed. On the next day the patient became febrile, had chest pain, and, at thoracotomy, perforation of the esophagus and mediastinitis were noted. The patient's course was stormy, terminating in oliguria and increasing azotemia. This led to the patient's transfer to this institution. The patient died shortly after admission here. Postmortem revealed the esophagus to be normal except for the sutured perforation. Mediastinitis and findings consistent with acute renal insufficiency were believed to have caused death.

Summary

A simple harmless method is advocated for the dislodgement of animal or vegetable matter from the esophagus.

The passage of a relatively large-sized (26 to 30 F.) firm rubber tube into the stomach seems quite sufficient for this purpose, without preliminary esophagoscopy.

The reason for obstruction in the upper part of the esophagus by meat, in an apparently normal esophagus, is not clear.

A case is also reported in which death ensued from the sequelae of esophageal perforation secondary to forceps removal of a retained meat particle during esophagoscopy.

This method is not advocated for removal of metallic objects or bones lodged in the esophagus.

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Nasopharyngeal Malignant Tumors in Surabaja and Vicinity (Indonesia)

Preliminary Report

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The incidence of carcinoma of the nasopharynx is high among Indonesian natives.

The data for this paper were compiled from the histological material in the Department of Pathology, Surabaja Medical School. The material included biopsy and surgical specimens from 160 patients with malignancy of the nasopharynx examined during the years 1952-1955. Some of this material was obtained from patients in hospitals in East Java, the eastern part of Indonesia, but most of it from the Central Hospital in Surabaja.

Of the 107 Indonesian patients with malignancy of the nasopharynx, 75 were men and 32 were women, resulting in a ratio of 2:1.

Teoh [1] stated that the incidence of nasopharyngeal carcinoma in men was at least twice as much as in women.

The findings of Mekie [4] and Digby [3] showed an incidence of 3:1 and 2:1 respectively.

Table 1 lists the relative frequency of malignant tumors affecting various organs in Chinese and Indonesians during the same years. Routine autopsy was not done, and consequently the figures for liver and lung cancer were not included. Cancer of the nasopharynx occurred frequently in both the Chinese and the Indonesian races. Cancer of the neck also occurred frequently in the Indonesians. Although these figures did not reflect the true incidence of malignant growths, it did give some impression of the frequency of the different types of cancer in Indonesia, particularly the malignant growths of the nasopharynx, neck, and uterus (choriocarcinoma).

TABLE 1.—*Frequency of Malignant Tumors Among Indonesians and Chinese During the Years 1952, 1953, and 1954 from Microscopic Specimens Compiled at the Department of Pathology, Medical School, Surabaja, Indonesia*

Site	No. of Cases Among Indonesians	Percentage	No. of Cases Among Chinese	Percentage
1. Uterus	281 *	31.8	108	50.2
2. Skin	154	17.4	8	3.7
3. Breast	71	8.0	24	11.1
4. Neck	71	8.0	10	4.7
5. Nasopharynx	70 †	7.9	30	13.9
6. Mouth	41	4.6	1	0.5
7. Gastrointestinal tract	55	6.2	23	10.7
8. Thyroid gland	42	4.7	1	0.5
9. Ovary	40	4.5	3	1.4
10. Eye	27	3.1	1	0.5
11. Male genitalia	21	2.4	6	2.8
12. Bone	12	1.4	0	—
Total Number	885	100	215	100

* The patients with cancer of the nasopharynx were from Surabaja and Malang only.

† The malignancies listed in the Table represented patients from the entire eastern part of Indonesia.

As Table 1 indicates, cancer of the nasopharynx was one of the commoner malignancies in Surabaja and vicinity. This figure was probably low because only Surabaja and Malang were served by a qualified otolaryngologist.

Table 2 shows the frequency of nasopharyngeal carcinoma in peoples of different

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Department of Pathology, University of Airlangga, Medical School (Dr. Djojopranoto); Chief, Head and Neck A. Service, Roswell Park Memorial Institute (Dr. Marchetta).

TABLE 2.—*Incidence of Nasopharyngeal Malignant Tumors During 1952-1955 from Microscopic Specimens at the Department of Pathology, Medical School, Surabaja*

Race	1952	1953	1954	1955	Total
Indonesians	16	26	28	37	107
Chinese	8	8	14	17	47
Caucasian	2	2	—	2	6

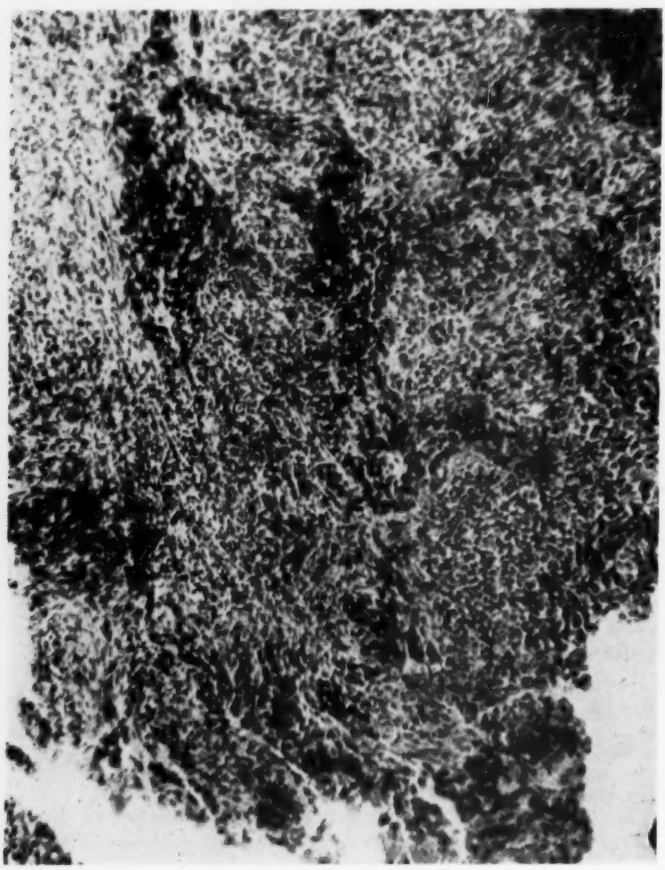
TABLE 3.—*Classification of Nasopharyngeal Malignant Tumors*

Epidermoid carcinoma	6
Anaplastic carcinoma	73
Reticulum-cell sarcoma	10
Lymphosarcoma	2
Fibrosarcoma	1
Unclassified malignant tumor	8

races. Indonesian as well as Chinese people appeared highly susceptible. The increasing number of nasopharyngeal malignancies reported in the years 1954 and 1955 was due to the fact that this disease was more frequently considered in the differential diagnosis and that the Department of Otorhinolaryngology had more recently added staff members with specialized training.

The slides from 100 cases were carefully reviewed and classified by one of us (M. D.) (Table 3).

Transitional-cell carcinoma and lymphoepithelioma were included under the heading anaplastic carcinoma. The eight unclassified tumors presented a problem in differential diagnosis between carcinoma and sarcoma.



Tissue from nasopharynx, anaplastic carcinoma.

It was often difficult or impossible to distinguish between diffuse anaplastic carcinoma and reticulum-cell sarcoma, especially from a small biopsy specimen. The histological features in both the primary growths and their metastases showed marked structural variations, even in a single tumor. It was believed that many of the reticulum-cell sarcomas and unclassified tumors in this material belonged in the group of anaplastic carcinomas. Reticulum stains would have been helpful in differentiating reticulum-cell sarcoma from anaplastic carcinoma.

Teoh[1] of Hong Kong in his careful necropsy and histological studies of 31 cases of nasopharynx carcinoma concluded that tumors previously designated as lymphoepithelioma and transitional-cell carcinoma were epidermoid carcinoma with varying degrees of differentiation. Lawley,[11] in his pathological study of 170 cases of nasopharyngeal cancer, also made similar conclusions.

Comment

The racial susceptibility of Chinese people to nasopharyngeal carcinoma has been known for 25 years. Digby[3] reported that in Hong Kong nasopharyngeal carcinoma was the second commonest variety of malignant disease and that it represented 18% of all malignant cases. Mekie and Lawley[4] reported that in Singapore the incidence of nasopharyngeal cancer was 16.14% of all malignancy. In the report of Martin and Quan,[2] which dealt with an over-all series of 358 cases of nasopharyngeal cancer observed and treated on the Head and Neck Service of the Memorial Hospital, 1935 to 1950, 10% were found among people of Chinese descent.

In contrast to the high incidence of this malignancy found among the Chinese people, Goltfredsen[5] collected 454 cases from the Scandinavian Radiological Clinic and stated that nasopharyngeal carcinoma constituted 0.4% of all cases of cancer occurring in Scandinavia. This figure agreed with that of Molony[6] in Canada, who estimated the frequency of this disease to be 0.3% of all malignant disease.

Martin and Quan[2] doubted whether this predilection for nasopharyngeal carcinoma extended to other Oriental races. Tulsi Das, Taneja, et al.[7] studied cases of nasopharyngeal cancer in Victoria Jubilee Hospital Medical College, India, and Tata Memorial Hospital, Bombay, India, and concluded that nasopharyngeal carcinoma among Indians was rare. Their figures agreed with those of European and American authors. This neoplasm was also reported to be rare among Japanese people.[8] Reports in the medical literature pertaining to the incidence of nasopharyngeal malignancy among the Indonesian natives were not found.

However, a high incidence of malignant tumors of the lymph nodes in the neck has long been recognized in Indonesia. Bonne,[9] in his article "Cancer and the Human Races," states: "A problem which presents itself with regard to the incidence of cancer in the Far East is the frequency of malignant tumors of the lymph nodes of the neck. Such tumors rank fifth among the Indonesians, and fourth among the Chinese of Batavia, fifth of the Chinese of Singapore and fourth among the Fillipino population of Manila."

Bonne[9] described two kinds of growths found in these malignant lymph nodes: 1. A number showed diffuse growth of densely packed more or less round cells, often completely replacing the original tissue of the lymph nodes. Compared with the nuclei of the remaining lymphocytes, the nuclei of the tumor cells stained less darkly but were not especially hypochromatic. The amount of cytoplasm was rather small; the production of reticulin was considerable and it was everywhere visible between the cells in a reticulin staining preparation. 2. A much larger number of cases consisted of pale syncytial cells with definite hypochromatic nuclei, each nucleus containing a prominent nucleolus but otherwise very little chromatin. Instead of growing diffusely they formed

well-defined strands of tumor tissue, leaving unaltered lymphoid tissue in between and giving the impression on first sight of being metastatic carcinoma. *Reticulin was absent in the typical cases or present only in small amounts.* These tumors were called reticuloendothelioma.

Bonne[9] was not convinced that the nasopharynx was necessarily the primary site of growth. In a few autopsies of such cases Bonne found nasopharyngeal tumors in some but not in others. There was, however, a striking similarity between the structure of the malignant lymph-node tumors described by Bonne and malignant tumors of the nasopharynx.

Thompson, as early as 1923, had commented on the high incidence of what he termed "cervical lymphosarcoma" among the Chinese living in Canton, China. Thompson mentioned in passing that 47% of the patients complained of nasal obstruction. This suggested that in these cases the primary lesion may have been in the nasopharynx, a contingency which was entirely missed by the author.

Whiteleather[10] stated that transitional-cell carcinoma was, in his experience, the commonest variety of tumor found in the nasopharynx. Metastasis to the lymph nodes of the neck was a very common, early feature.

Trotter divided his cases into two types: (1) those that were polypoid and extended into the nasopharynx and produced symptoms of nasal and pharyngeal obstruction; (2) those in which polypoid development was absent. This second type of tumor was commoner and much more difficult to diagnose. A curious characteristic of the growth was its tendency to spread widely beneath the mucous membrane without causing ulceration. This was also emphasized by Capell in his study of lymphoepithelioma.

In view of the foregoing facts—(*a*) that there was a striking similarity between the tumors described by Bonne and the histological structure of nasopharyngeal tumors, (*b*) that metastases to the lymph nodes of the neck were a common early feature of carcinoma of the nasopharynx, (*c*) that many nasopharyngeal carcinomas remained small and tended to spread widely beneath the mucosa without causing ulceration—it seemed possible that many cases of so-called primary cervical "reticulosarcoma or reticuloendothelioma" mentioned by Bonne were in reality metastases from a nasopharyngeal malignant lesion. The high incidence of both nasopharynx malignancies and malignant tumors of the neck among Indonesians may represent a similar relationship.

Summary and Conclusions

One hundred sixty cases of nasopharyngeal cancer were examined by the Department of Pathology, Surabaja Medical School, Indonesia, between the years 1952 and 1955.

The majority of nasopharyngeal malignancies were epidermoid carcinoma with varying degrees of differentiation.

Not only the Chinese but also the Indonesians have a high incidence of nasopharyngeal cancer.

It is proposed that many of the so-called "primary cervical reticulum cell sarcomas or reticulo-endotheliomas" mentioned by Bonne were actually metastases from carcinoma of the nasopharynx.

A diagnosis of a primary cervical malignant lesion of the neck must not be made until every diagnostic tool is used for a thorough and complete examination of the nasopharynx.

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Roswell Park Memorial Institute (3) (Dr. Marchetta).

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Sudden Deafness Due to Cerebellopontine-Angle Tumor

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The sudden loss of hearing by an apparently healthy person is an unusually alarming symptom. Roaring tinnitus is almost always associated, and true vertigo may be associated. A careful history has to be taken, however, in order to determine whether the deafness actually came on suddenly. Deafness may and occasionally does come on like "a bolt from the sky." When this does occur, the deafness is likely to be associated with vascular changes, such as atherosclerosis,[1] and is often, but not always, total and permanent.

Since sudden deafness is seldom associated with an immediate fatal event or disease, factual information about the pathologic process underlying the loss of function is obscure.[2] Several causative factors are suggested, however: (1) vascular changes such as thrombosis, spasm or hemorrhage of the auditory apparatus; (2) toxic involvement of the cochlea or eighth nerve; (3) neuritis of the eighth nerve; (4) systemic diseases, such as blood dyscrasias; (5) acute rise of pressure in the labyrinth (Ménière's disease); (6) an anaphylactic phenomenon; (7) emotional factors; (8) pressure as from tumor, and (9) trauma to the head.

Recently, we have seen two patients in each of whom unilateral sudden deafness was associated with a cerebellopontine-angle tumor.

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Section of Otolaryngology and Rhinology (Dr. Hallberg), Section of Neurologic Surgery (Dr. Uihlein), and Section of Neurology (Dr. Siekert), Mayo Clinic and Mayo Foundation. The Mayo Foundation, Rochester, Minn., is a part of the Graduate School of the University of Minnesota.

Report of Cases

CASE 1.—A 49-year-old woman came to the Mayo Clinic in December, 1957. She had been well until three years prior to admission, at which time she lost the hearing in the left ear overnight. At that time she had no associated symptoms such as tinnitus or vertigo. In May, 1957, she was involved in an automobile accident without apparent injury to the head. Three weeks after this she first noticed aching in the lower part of the back after walking, which was relieved by sitting. She also began to experience episodic vertigo for 5 or 10 minutes in the morning soon after arising. She stated that the room would spin around, but nausea, vomiting, or tinnitus never occurred. This vertigo occurred only two or three mornings a week, but the episodes persisted unchanged to the time of admission.

Four months prior to admission, difficulty with the lower extremities appeared for the first time. The patient stated that they were clumsy and unsteady, and that at times she would stagger and fall. She first noticed clumsiness while ascending stairs, and it seemed to worsen in the next several weeks. Although she thought the legs were slightly weak, the main problem was that she could not control them. If this had become worse in the month or two before admission, the advance had been very minimal. Three weeks prior to admission, episodic blurring of vision began. She never had any double vision or scotomata, only generalized decrease in vision which lasted about five minutes and occurred on the average of several times a day. It was not related to anything so far as she could state.

Findings on general examination at the clinic were normal. The neurologic examination revealed early bilateral choked disks (elevated less than 1 D.), without hemorrhages or exudates. Perimetry disclosed only slightly enlarged blind spots. The left corneal reflex was slowed slightly. On gaze to the left minimal nystagmus was elicited. Hearing was absolutely gone on the left; it was normal on the right. Generalized hyperreflexia, severer on the left than on the right, was present in the upper extremities with Hoffman's sign on the left. Ability to hop on each foot was poor, but was worse on the left. Alternate motion rate was depressed in the left hand and foot and the tongue

Slight incoordination of cerebellar type was present on movements of the left upper and lower limbs. There was no sensory loss or facial or motor weakness.

In the electroencephalogram moderate dysrhythmia was evident in the sylvian leads, being maximal on the left. The response to caloric stimulation was normal in the right ear and absent in the left. There was no response on audiogram on the left with high masking. Roentgenograms of the skull, including Stenver's and Towne's views, showed no abnormalities.

Several days after admission headaches appeared and the patient became drowsy. At times she was comatose and cyanotic; at other times, relatively alert. Episodic vomiting occurred. Later on the same day bilateral occipital burr holes were placed, and ventricular drainage was instituted to relieve increased intracranial pressure.

Two days later a suboccipital craniectomy was carried out with removal of a neurofibroma of the left cerebellopontine angle. The patient's postoperative course was uneventful.

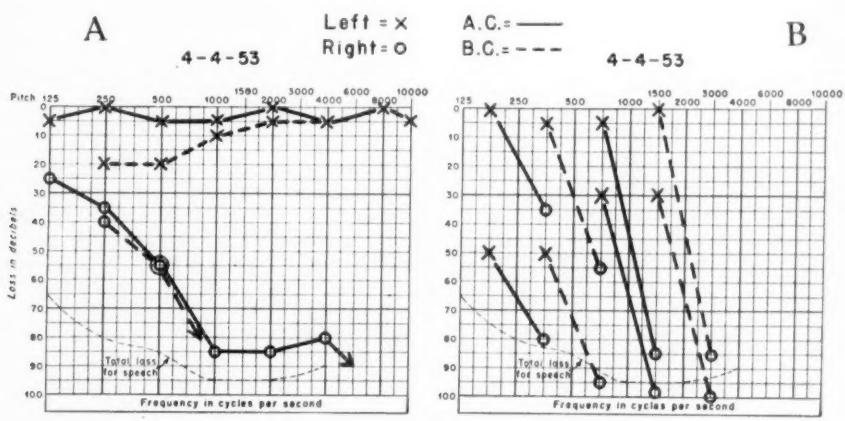
CASE 2.—A 56-year-old woman was seen at the clinic in April, 1953, for a general examination. She felt well. Review of symptoms revealed that in March, 1950, after exposure to a cold wind on the right side of her face, she had a mild upper respiratory infection. Concomitant with the onset of this she noted the sudden loss of hearing in the right ear and the appearance of a steady hissing noise. This noise was continuous for approximately six months and then disappeared. She did not experience any pain, vertigo, or weakness of her face during that time. A few weeks after the onset of the deafness, an audiogram indicated almost complete loss of hearing on the right side.

Neurologic examination at the clinic revealed the absence of hearing on the right and rotatory nystagmus on gaze to the left. Corneal reflexes, coordination, and so forth were normal. An audiogram showed marked loss of hearing on the right on air and bone conduction. There was conspicuous absence of recruitment in the right ear (Figure). It was felt that this test confirmed the diagnosis of a lesion of the cerebellopontine angle. Tests for labyrinthine function with the use of cold water revealed no evidence of response on the right. Roentgenograms of the head, including Stenver's and Towne's views, showed nothing abnormal. The value for total protein in the spinal fluid was 200 mg. per 100 cc. with 1 lymphocyte and 7,200 erythrocytes per cubic millimeter. The protein after correction for blood was 190 mg. per 100 cc.

The right cerebellopontine angle was explored, and a neurofibroma, 2.5 cm. in diameter, was removed. The postoperative course was uneventful.

Comment

Sudden deafness is uncommon, and its occurrence in association with tumors of the cerebellopontine angle is rare. In fact, gradual diminution of auditory acuity is considered a characteristic feature of such lesions.[3] Despite considerable literature on acoustic neurinomas,[4] almost no comment has been made on sudden deafness. It has been commonly observed that a person may first become aware of some loss of hearing under certain circumstances, as on using a telephone, only to continue having further progressive decline in hearing. Cushing,[5]



Audiogram and result of loudness-balance test of patient whose deafness was due to a tumor of the cerebellopontine angle. *A*, masking used for air conduction and bone conduction on right. *B*, binaural loudness balance shows conspicuous absence of recruitment in right ear.

in his monograph, mentioned two patients each of whom suddenly became deaf in one ear. One patient (No. 10) had had pain in the ipsilateral ear before the deafness began. The other (No. 26) noted ipsilateral blepharospasm one year prior to the onset of deafness associated with pounding in the ear.

In presenting a group of patients with difficult diagnostic problems, Meyer [6] described a patient (Case 3) who had the "apoplectiform" onset of decreased hearing and facial weakness on the right and weakness of the left limbs. Four years later a neurinoma was discovered in the right cerebellopontine angle.

Edwards and Paterson,[7] in an excellent study of 157 patients with acoustic neurinomas, mentioned five patients whose deafness was described as appearing abruptly. They commented that a preexisting defect may have escaped notice. This could apply to our cases, also, even though careful questioning indicated that no preexisting deficit was present.

Revilla [8] observed that a few patients became aware of their loss of hearing during mild infections. He implied that further progression in deafness took place. In our second case the hearing deficit appeared in association with exposure to a cold draft and an upper respiratory infection and was essentially complete at that time and, in so far as could be determined, showed no further progression.

The actual mechanism involved in the sudden loss of hearing cannot be stated with certainty. The suddenness certainly suggests a vascular occlusive basis, such as pressure on the internal auditory artery. The association of the draft and infection in the second case brings up edema as a contributing factor, just as it has been postulated in certain instances of Bell's palsy.

Further mention should be made of the alternate loudness balance test, described by E. P. Fowler, Jr.,[9] which helped us greatly in arriving at the correct diagnosis. In this test, a pure tone is alternately impressed on the two ears of the subject while intensities are adjusted to produce sensations of equal loudness. In this way, we measure auditory recruitment, a condition in which certain defective ears are more sensitive to changes in intensity of sound than are normal ears. This recruitment manifests itself in two ways: (1) sudden detection or awareness of the threshold of sound (the sound either is not heard or is heard too loudly), and (2) difference of loudness and pitch from the same tone. The lack of recruitment in the second patient, indicating pure nerve deafness, helped us arrive at the correct diagnosis. This test is a valuable adjunct in arriving at an early diagnosis in cerebellopontine-angle tumors.

Summary

Two cases of neurofibroma of the cerebellopontine angle are presented in which sudden deafness preceded the onset of other symptoms.

Mayo Clinic.

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Evaluation of Surgery in Conductive Deafness by "Per-Cent Improvement"

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At the present time there is unfortunate confusion in reporting the results of stapes mobilization surgery. As a possible remedy for this situation a method is proposed whereby the results of such surgery can be impartially analyzed. In fact all types of surgery aimed at correction of conductive auditory lesions can be objectively analyzed so that otologists may evaluate varying techniques and possibly cooperate in a standard method of reporting results.

It is understandable, but unfortunate, that the criteria of *fenestration* "success" have been carried over into the very different field of stapes surgery. Almost all otologists reporting results of stapes surgery have been impressed by the necessity of revising the method used in reporting fenestration results, but to date there has been no uniformity in the changes introduced, and consequently comparison of reports is difficult. This condition is particularly unfortunate since it tends to obscure the experiences of the various otologists active in this important field.

It is not the purpose of this paper to draw comparisons between stapes and fenestration surgery, but it may be pertinent to note certain reasons why the fenestration criteria of "success" are not valid as stapes surgery criteria. The physiological basis of the fenestration procedure puts the criteria of success on essentially an "all-or-nothing" basis, i. e., a procedure which is usually justified only when the patient can hope to reach "unaided hearing" by means of the operation. This level has been more or less arbitrarily fixed at 30 db. below the normal air-conduction response, and fenestration results should reach or surpass this empirical value to be considered "successful." Thus, the 30 db. level or better has been the usual criterion of fenestration success. Consequently, unaided hearing and surgical effectiveness have been frequently equated and confused.

As an example of this confusion we may compare two cases. In Case A, with a preoperative 10 db. B. C. and 40 db. A. C. (A. B. gap=30 db.), a postfenestration result of 30 db. (gain of 10 db.) is considered a "success." In Case B, with a preoperative 25 db. B. C. and a 70 db. A. C. (A. B. gap=45 db.) a postfenestration result of 45 db. (gain of 25 db.) is considered a "failure." While this evaluation may be correct from the point of view of the patient's psychosocial hearing status, it is an evaluation which is far from realistic physiologically. This confusion is further compounded in the case of stapes surgery by the increased latitude allowable in candidate selection.

Stapes mobilization, in contrast to fenestration, is a procedure of less magnitude. It has a wider field of application, since a partial improvement in hearing which would be inadequate by fenestration criteria may be justified and worth while in stapes surgery. Since "successful" results in stapes surgery are not necessarily defined by the postoperative 30 db. level, it is apparent that the effectiveness of a given surgical technique in removing the conductive block

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should be defined in different terms from the level and social effectiveness of the patient's postoperative hearing.

While the hearing gain which can be expected in a given case is a function of the effectiveness of the surgical procedure, and while, conversely, the surgical procedure is performed to achieve the maximum hearing gain, these two important factors belong in different categories.

In an analysis of 500 consecutive cases,[1] it has been observed that about one-half of these patients would have been denied the benefit of stapes surgery if all candidates had been rejected except those who could be expected to reach a postoperative level within 30 db. of normal. This same analysis of stapes surgery also shows that the probability of successfully closing the air-bone gap is equally good at all levels of bone-conduction response, down to 40 db. below normal. Response to surgery may be equally good somewhat below this figure, but there are not yet sufficient data to warrant a firm conclusion in this fringe area.

Perhaps the first step in obtaining some common ground on which to base our criteria is to obtain a common method of stating the various losses, gains, and levels encountered in this field. There are three current methods which are used to define hearing levels in a single figure.

1. Actual speech reception threshold test (spondee lists)
2. An average of the three threshold responses at 500, 1,000, and 2,000 cycles
3. An average of the best two threshold responses at 500, 1,000, and 2,000 cycles (Fletcher formula[2]).

The spondee speech reception threshold (No. 1) is ideal in many respects, but unfortunately, this test is time-consuming when properly administered, and is not always practical, especially during surgery. Because of the time factor involved, either No. 2 or No. 3 is preferable as a single "figure of merit." A survey has been made of 300 cases to obtain some idea of the relation of both these formulae to the spondee speech reception threshold. The results of this survey indicate that No. 2, the average of the three speech frequency thresholds, is within 1½ db. of the spondee S. R. T., while the Fletcher equivalent S. R. T. (No. 3) is within 4½ db. of the spondee S. R. T. Both formulae indicate a slightly better threshold than the actual, and they are thus 3 db. apart. The standard deviation from the real S. R. T. is 7 db. in both cases. It seems probable that this standard deviation of 7 db. is slightly greater than is justified, since it is observed that the departures of both threshold formulae from the spondee S. R. T. are, without exception, in the same direction and by about the same amount, when the departures are large. These relatively large departures (greater than 5 db.) are random (either plus or minus), but since they are expressing a correlation between the spondee S. R. T. and the two derived or equivalent S. R. T.'s, it seems probable that the relatively few cases of wide divergence may well be errors in the spondee S. R. T. rather than failures in both equivalent S. R. T.'s at the same time and in the same direction.

Since the single figure of merit obtained from these equivalent S. R. T.'s is used chiefly for comparison purposes, the fact that such a figure may be slightly better or worse than the spondee S. R. T. is of little importance so long as the standard deviation is reasonably small. In this respect there is little choice between the Fletcher equivalent S. R. T. and the average of the three speech frequencies. Since the difference of 3 db. is essentially constant, such a difference appears immaterial. For convenient use by the otologist and by the surgical audiometrist, the Fletcher equivalent can readily be computed mentally, whereas the average of the three threshold frequencies require in most cases pencil addition and division. It is thus our opinion that the Fletcher equivalent S. R. T. is adequate as a single figure of merit and sufficiently more convenient in use to justify its adoption as a standardized expression of the various gains and losses which must be clearly stated in stapes surgery. However, regardless of

which formula is adopted, it is felt that standardization of some formula is a prime and initial requirement.

Hearing Adequacy Factor

While our major consideration here is concerned with uniform reporting on surgical effectiveness, it may be well to state our concept of the conditions which justify stapes surgery. The following three conditions are considered to provide a framework or guide for selection of stapes surgery candidates in patients clinically diagnosed as otosclerotics.

1. An air conduction loss of 35 db. or more
2. A speech discrimination score of 60% or better
3. An air-bone gap of 20 db. or more

All of the above are subject to modification in individual cases. Thus, there are occasional patients who desire help through surgery even though the air-conduction level is not as low as 35 db. Adequate speech discrimination is, of course, a prime requirement, since the removal of the conductive block acts in essentially the same way as amplification of the applied signal. Thus, if discrimination with adequate amplification is initially poor, it is not likely to be materially improved by surgery, except in some cases where the lesion may be the cause of the distortion which reduces intelligibility.

The discrimination value stated is, of course, subject to modification in individual cases, since alertness, intelligence, and language familiarity of the individual may materially modify the discrimination score.

The air-bone gap (No. 3) is, in general, a measure of the maximum improvement which can be expected, but this minimum figure of 20 db. is also subject to some modification. For air-conduction losses of over 40 db. the figure of 20 db. should be considered minimum; as the air conduction loss reaches a level of 60 db. or more, the required gap should be increased. It will be noted that there is no fixed limitation stated for maximum loss by air conduction or bone conduction. However, such limitation is implicit in the No. 2 condition which requires a reasonable preoperative speech discrimination score. Thus, extreme losses in either air or bone conduction are not likely to meet the speech discrimination requirements. This minimum speech discrimination score also tends to increase the air-bone gap automatically as the air-conduction loss becomes more than 70 db. This is due to the poor speech discrimination usually attendant on bone conduction losses greater than 50 db. While patients with an air-conduction loss of more than 50 db. and an air-bone gap of 20 db. could not normally expect to reach the 30 db. of unaided hearing, it should be realized that there is a considerable amount of useful hearing between 35 and 45 db., and a 20 db. gap, if closed, may well bring a patient to this area (35-45 db.), in which the ear can be used for telephone conversation, in which alarm clock and telephone bells can be heard unaided, and in which unaided hearing in noisy locations is quite adequate.

Thus the person with an air-conduction loss of 65 db. or less, which has improved to 45 db., can potentially enjoy a marked improvement in social adequacy, even though the hearing aid is still essential for comfortable communication under usual conditions. When the air-conduction loss reaches 70 db. or more, a 20 db. minimum gain cannot be expected to do more than reduce the required amplification of a hearing aid, but such a reduction in amplification is frequently worth while, since many hearing aids do not have adequate power-handling capacity for an acoustic gain of more than about 60 or 65 db. Thus the high-gain hearing aid frequently distorts loud signals because of overload, and speech discrimination is consequently less than ideal.

Another unfortunate condition which exists when the hearing aid must work at such high acoustic amplification, is acoustic feed-back between receiver and microphone, which causes squealing and is embarrassing both to the wearer of the aid and to others.

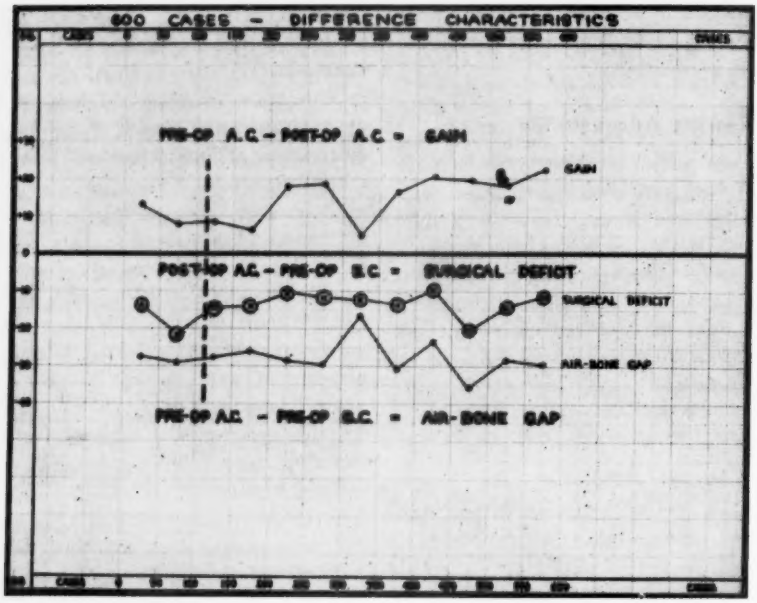

600 CASES - DIFFERENCE CHARACTERISTICS
PRE-OP A.C. - POST-OP A.C. = GAIN
GAIN
POST-OP A.C. - PRE-OP B.C. = SURGICAL DEFICIT
SURGICAL DEFICIT
AIR-BONE GAP
PRE-OP A.C. - PRE-OP B.C. = AIR-BONE GAP

Fig. 1.—Auditory difference characteristics in 600 cases of stapes surgery. Points shown are averages of 50 case groups.

Thus a reduction of 20 db. in the required amplification of the hearing aid will in many cases be well justified by the reduction in overloading and acoustic feed-back of the hearing aid resulting in a marked improvement in communication.

Criteria of Surgical Success

The gain or improvement that a surgeon can expect to obtain in any given case is a function of his skill, the technique employed, and an unknown variable factor determined by the type of lesion encountered. Because of this unknown variable, the probability of success can only be stated as an average, and, like all averages, the results of any individual case may be considerably above or below the average.

It was proposed some years ago by Davis and Walsh [3] that fenestration surgery be evaluated apart from the conventional 30 db. criterion by comparing the postoperative air-conduction to the preoperative bone-conduction level. This was called the "surgical deficit," which measured the amount by which the postoperative air conduction failed to reach the level of preoperative bone conduction. This is the amount by which the air-bone gap is not closed. The surgical deficit criterion is also applicable to the evaluation of stapes surgery, and has been used by us as a better method than any other available to date for reporting purposes. Critical examination of the surgical deficit, however, indicates that it is unduly influenced by the value of the preoperative air-bone gap.

Figure 1 shows the surgical deficit for averages of 50 case groups over a total range of 600 cases. Plotted above the zero line is the average air-conduction gain in each of the 50 case groups, and plotted just below the surgical deficit characteristic is the preoperative air-bone gap for each group. In the group 300 to 350, it will be noted that the average air-conduction gain dropped sharply. This condition, however, is not reflected in the surgical deficit, since it also happened that the average air-bone gap in this group was only about 16 db. The sharp reduction in gain in this area was due to inadvertent footplate fenestra-

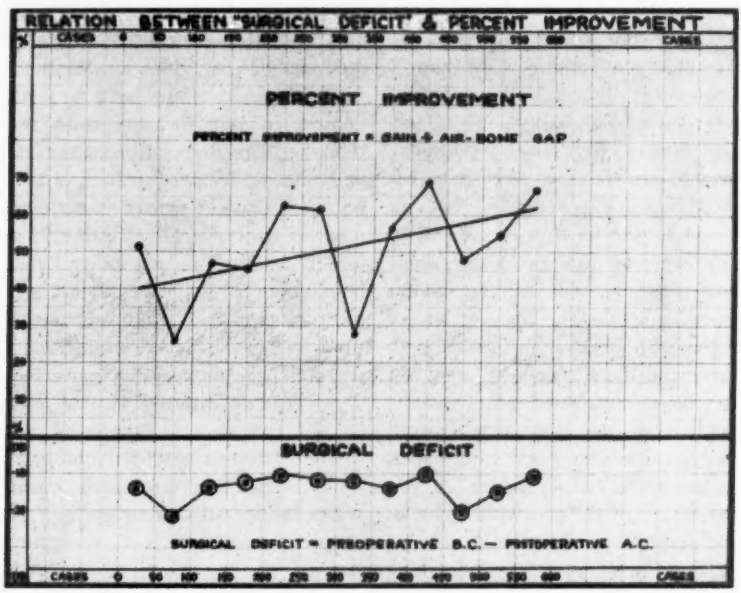
tion, and it will be apparent that any criterion of surgical effectiveness should have shown such a condition regardless of any combination of patient parameters. In the group 450 to 500 will be observed a relatively sharp dip in the surgical deficit characteristic. Inspection of the air-bone gap in this group, which is greater than usual, shows again the close relation between these two characteristics. It will be noted that the air-conduction gain did not drop appreciably in this group. Pursuing this apparent defect in the surgical deficit characteristic, it may be of interest to state an absurd example. If a surgeon were to select patients with not more than a 10 db. air-bone gap, he would then be able to demonstrate an excellent surgical deficit (10 db. or better) even before surgery.

It will be apparent from the foregoing that the surgical deficit is not completely independent of the various forms of patient selection and is thus not an ideal measure of the effectiveness of surgery. It is proposed, therefore, that another criterion be adopted which will not only be independent of patient parameters, but which will also be more sensitive to changes in technique and other elements which control the final results.

It is proposed that the air-conduction gain actually realized be divided by the preoperative air-bone gap, which is the maximum expected gain. The resultant fraction can be considered as a percentage that will indicate the degree of removal of the conductive block, and is thus a measure of the surgical success.

Figure 2 shows the same groups of 50 in a total of 600 cases as previously shown in Figure 1. In addition to the surgical deficit, which is the same as before, there is shown the proposed evaluation characteristic to be called "per-cent improvement." It will be observed that the sensitivity of this method of reporting results is far higher than that of the surgical deficit. It is also of interest to observe the 300 to 350 group which was noted in connection with Figure 1, where the average gain drops to about 4½ db. This condition did not show in the surgical deficit characteristic, but a very sharp drop

Fig. 2.—The proposed "per-cent improvement" characteristic compared with the "surgical deficit." The difference in response to the same average groups of cases is apparent.


RELATION BETWEEN "SURGICAL DEFICIT" & PERCENT IMPROVEMENT
CASES
PERCENT IMPROVEMENT
PERCENT IMPROVEMENT = GAIN ÷ AIR-BONE GAP
SURGICAL DEFICIT
SURGICAL DEFICIT = PREOPERATIVE B.C. — POSTOPERATIVE A.C.
CASES

Comparison of Surgical Deficit and Per-Cent Improvement

At 6 Months Postop.	Surgical Deficit	Per-Cent Improvement
All Cases	12 Db.	62%
Cases showing 5 db. or more gain at mobilization	11¼ db.	65%
Cases showing 7½ db. or more gain at mobilization	10½ db.	68%

to approximately 27% improvement will be noted in the proposed per-cent improvement characteristic. Furthermore, the group between 450 and 500, which shows such a marked drop in surgical deficit, shows some dip in per-cent improvement, but nothing comparable to that displayed by the older criterion.

The accompanying table compares the surgical deficit and per-cent improvement in this same group of 600 cases.

The values reported for "All Cases" include cases which did not mobilize at surgery as well as all others. The other two values shown are for conditions in which the cases that did not mobilize at surgery are eliminated from both "Surgical Deficit" and "Per-cent Improvement" figures. Some stapes surgeons consider that an improvement of 5 db. indicates a degree of mobilization. It has been our policy, however, to consider that unless something more than 5 db. in audiometry is observed, the condition is essentially one of no change. Thus, we have shown figures for both conditions. With respect to the relative sensitivity of the two methods of reporting surgery, it should be noted that in this example the per-cent improvement figures change four times faster than the db. figures under surgical deficit.

Each surgeon should develop his own per-cent improvement figure, and as soon as enough cases have been processed to justify conclusions he can use his own figures in predicting the probable results of stapes surgery for the individual candidate.

Using the figure of 62%, which includes all cases, the probability of "success" can be stated in either of two ways. Any individual candidate has a 62% chance of eliminating the air-bone gap, or stated another way, the air-bone gap will probably be reduced by 62% in all cases. Either statement is true with respect to the average condition, but, as previously noted, individual cases may depart materially from any average.

Individual cases may show per-cent improvement greater than 100%, since improved perilymph mobility may improve the postoperative bone conduction well above preoperative conditions. The air-conduction gain may thus be greater than the preoperative gap; however, this is still an accurate reflection of conditions in which the realized gain was greater than the normally expected gain. There are also cases where air-conduction losses occur which are the equivalent of negative gains. In such cases, the difference between preoperative and postoperative air is divided by the preoperative air-bone gap in the usual fashion, but the percentage is stated and recorded as a minus value. For averages this negative percentage adds algebraically to the usual positive percentages.

It has been stated by some that any evaluation method relying on air-bone gap as a principal factor is unreliable, since bone conduction is known to be less than perfect as a measure of cochlear reserve. This objection, however, does not seem to be well founded, since, if we were to demand perfection in our measurements, we would then be forced to abandon practically all audiometric tests. Furthermore, it should be noted that the errors of bone-conduction measurement are all effective in the same direction; that is, assuming that the ear responding is the ear under test, there is always as much cochlear function as is measured by bone conduction and there may be more. Thus, bone-conduction errors will always tend to improve results as measured by any criteria.

We hasten to note that nothing proposed here would interfere with evaluation of either individual case or group reports with respect to the 30 db. level when such a measure of the approach to unaided hearing

seems desirable. However, attainment of the 30 db. level is at least as much of a measure of candidate selection as it is of the surgical efficacy of a given technique. Thus at the present state of our knowledge, the only quantitative uncontaminated method of evaluating the efficacy of surgery for conductive deafness is by measuring the degree of closure of the air-bone gap. This can most easily and accurately be expressed as a percentage of complete closure of the gap.

We have been chiefly concerned here with a method of evaluation for stapes surgery, but the proposed per-cent improvement criterion can be applied equally well to any surgery aimed at eliminating or reducing conductive defects in the middle ear. This could include the various forms of tympanoplasty and fenestration as well as stapes surgery.

Summary

To facilitate individual evaluation of techniques in middle-ear surgery and to make comparison of results possible, it is proposed that a clear division be made between the degree of surgical success in removing the conductive block and hearing adequacy. Separate proposals are made herewith for both the evaluation of stapes surgery candidates and the evaluation of surgical results. The latter formula is applicable to tympanoplasty and fenestration as well as stapes surgery.

$$\text{Per-cent Improvement} = \frac{\text{Air-Conduction Gain}}{\text{Preop. Air-Bone Gap}}$$

"Per-cent improvement" is advocated for evaluation of surgery for conductive deafness. If one wishes dual evaluation, both the per-cent improvement formula and the 30 db. level may be used in analyzing results without conflict.

2007 Wilshire Blvd. (57) (Dr. Goodhill).

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Chronic Purulent Postnasal Discharge

Effectiveness of Antimicrobial Agents as a Therapeutic Supplement

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Although chronic purulent postnasal discharge and chronic "postnasal drip" are used synonomously by some writers, the terms designate different processes attributable to different causes. Irrespective of the character of the discharge, the symptom invariably proves annoying and provokes other symptoms, of which hawking and coughing are the more prominent. The only type of chronic postnasal discharge capable of endangering health, according to Proetz,[1] is the one carrying virulent organisms. In this connection, Proetz stated: "Among the many cases examined this type is relatively infrequent. It should be pointed out that it is the function of nasal mucus to carry off pathogenic organisms and that in these cases the postnasal 'drip' complained of is evidence of protective activity, cessation of which would augment the seriousness of the nasal infection."

Although this presentation deals primarily with the chronic purulent type of postnasal discharge, frequent reference to so-called "postnasal drip" was unavoidable. It is realized, however, as stated at the outset, that the two processes do not have the same implications.

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Review of Literature

Proetz,[1] in discussing the problem of "postnasal drip," emphasized that the process is usually harmless and the result of conditions of modern living, some of which are irremediable. He stressed also that it is sometimes a physiological response to irritants which it mitigates or removes. In his opinion, directing treatment to the sinuses will often fail because the cause lies elsewhere.

The mechanics of the nose, with special reference to nasopharyngeal discharge, was described by Tremble.[2] This worker held that postnasal discharge should be considered as a complaint rather than a specific infection and that infection and nasal obstruction account for the majority of cases. On the basis of this assumption, he recommended that these causes should be eliminated, if possible.

Bryant [3] directed attention to enlargement of the posterior tip of the inferior turbinate as a cause of postnasal discharge. He described a method entailing the application of phenol to the involved turbinal process and claimed thereby favorable results in controlling the postnasal drainage.

Pruzanski [4] duplicated Bryant's results but only in a limited number of patients. He was more successful, however, when he resorted to intranasal submucous injections of a sclerosing 5% solution of phenol in olive oil into the inferior concha, as advocated by Marks.[5] With the latter procedure he observed full recovery in 46% of a series of 50 patients.

Richards [6] concurred in the views expressed by other clinicians, as concerns the etiology of chronic "postnasal drip," but

laid particular emphasis on the influence of abnormal nasal function. Because the etiology is so varied, he believed no single remedy could prove universally successful. Richards maintained there is a difference between "postnasal drip" and postnasal discharge, the former, in his opinion, never being caused by sinusitis or allergy. He held, moreover, that patients suffering from postnasal discharge do not complain of the symptom, whereas patients with "postnasal drip" usually let you know promptly of its annoyance.

Review of Etiology

In reviewing the etiology, frequent borderline situations have made it difficult, and sometimes impossible, to separate the causes of chronic purulent postnasal discharge and chronic "postnasal drip."

Physiology.—Various factors lead to or contribute to faulty nasal function. If the nasal mucosa through its ciliary mechanism fails to cleanse itself of secretions, as it normally should, forces tend to divert the foreign material (purulent or nonpurulent) to its easiest route of exit, bypassing its conventional route.

Local Processes.—Nasal sinus disease is one of the more likely causes if the postnasal discharge is purulent. In this regard, nasal sinus disease embraces other pathologic processes than infection.

An infected lymphoid mass in the nasopharynx frequently provides the source of a postnasal infection. Since the postnasal space is an open reservoir, some of its tenacious drainage product may cling to the posterior pharyngeal wall, while that of a thinner, or less viscid, consistency drips to the structures below.

Anatomic Abnormalities.—Intranasal anatomic irregularities pose the problem of how to manage them. The tendency to resort to surgical intervention without regard for its influence on nasal physiology has been discouraged in recent years. Minor abnormalities produce no problem and require no treatment. Major deviations should be adjusted only if they interfere with nasal function. Richards[6] pointed out that turbinal hypertrophies, for example, are more likely to produce symptoms of nasal obstruction than "postnasal drip."

General or Systemic Influences.—An abnormal physical state of the patient frequently will prolong, if not provoke, certain types of postnasal drainage. In some organic diseases, like diabetes, the drainage usually is difficult to control and will persist despite intensive local and systemic treatment. In the convalescent stage of some respiratory tract infections, purulent postnasal discharge is common and early borders on chronicity, if uncontrolled.

Habits.—Irregularity of habits, especially in relation to diet, excessive use of alcohol and tobacco, and inadequacy of rest are factors which must be included in the total etiologic pattern.

Allergy.—Though allergy as a cause of chronic postnasal discharge has been overemphasized, its relationship is a significant one in some patients. Adequate control of the allergic state is paramount to producing cure.

Hormonal Dysfunction.—Evidence is available to point to hypometabolism as a cause of postnasal discharge.[7] According to Proetz,[1] among the endocrine disturbances thyroid deficiency is by far the most frequent cause of postnasal discharge. Richards[6] has concurred in this view, though stressing that it is often difficult to prove a relationship between the ductless glands and nasal hypersecretion. Here, as in other situations, the postnasal drainage more often is of the nonpurulent type.

Stress and Psychological Factors.—On rare occasions, stress and emotional states affect the whole person. With a breakdown of the body's defensive mechanism, nasal and postnasal infections may manifest themselves and lead to postnasal discharge.

Miscellaneous Causes.—Occupational irritants such as dust, fumes, and the like, and environmental temperature changes often provoke hypersecretion of the nasal

mucosa. Under some circumstances, purulency is a factor to be dealt with.

Some drugs normally, others through overuse, produce sufficient irritation of the nasal mucosa to result in hypersecretion, but purulency develops only if a latent intranasal infection is present.

Diagnostic Aspects

Before undertaking treatment of chronic postnasal discharge, a comprehensive general examination of the patient is highly essential as a guide. Since the source of the infection will vary from patient to patient, and because the prognosis often will depend on the feasibility of its approach, every effort should be made to determine its precise situation. Cooperation of the internist to assess the patient's physical state is essential. The results of such assessment should be correlated with the results of a complete ear, nose, and throat investigation. Clinical findings should be aided and confirmed if necessary by roentgen films and routine laboratory tests to ensure accuracy.

Of special importance is the bacteriologic study and the performance of standard sensitivity tests of the purulent discharge.* Swabbings of the nasopharynx and specimens of coughed-up sputum collected in sterile containers are utilized for this purpose. These tests provide the information necessary to establish the rationale for supplemental antimicrobial therapy.

Present Study

A group of 50 patients with chronic purulent postnasal discharge due to various causes was selected for this study. After the customary history taking, these patients were subjected to general physical and nose and throat examinations. On the basis of the findings, local and systemic treatment was instituted. The purpose was to remove or correct any possible associated factors. Of the entire group, only 10 (20%) gave distinct evidence of improvement. The remaining 40 (unimproved) patients were then given the benefit of supplemental antimicrobial therapy, the choice of which was guided by bacteriologic examinations and sensitivity tests. Of the 40 patients, 24 (60%) responded favorably to this additional treatment. In fact, 18 of the 24 could be considered cured, as the purulency did not relapse after a three-month period. Although several of the remaining 16 patients showed varying degrees of improvement under supplemental antimicrobial treatment, the results could not be classed as satisfactory. Since the 40 patients who were treated with antimicrobial agents had failed previously to improve on routinely practiced measures, they served, in a sense, as their own controls.

It is necessary to point out here that, in the original therapeutic recommendations, correction or elimination of certain existing habits played an important role in obtaining a favorable response in some patients. Excessive smoking ranked as the most hazardous responsible habit. Even after the purulency cleared up, the postnasal discharge, though of a different character, persisted in some patients until the smoking habit was discontinued entirely.

It is of interest to note that of the entire group of 50 patients, only 15 presented definite clinical and roentgenologic evidence of nasal sinus disease. Although conventional measures had been carried out (in four, surgical intervention), complete abatement of symptoms was not experienced until indicated antimicrobial agents had been administered.

In 16 of the 50 patients, despite exhaustive search for local causes, none could be ascertained. This does not imply that local causes were absent. It merely suggests that often, despite every diagnostic effort, local causes remain obscure. It is possible that some intercurrent systemic disease or borderline process, such as a subclinical allergy, was the influencing factor.

Bacteriologic Studies.—Examination of cultured material from the nasopharynx of most of the patients showed hemolytic

* Bacteriological and other tests entailed in this study were performed in the laboratories of the Mount Sinai Hospital of Greater Miami.

Staphylococcus aureus, Pseudomonas aeruginosa, and Neisseria sicca (Diplococcus pharyngis siccus) to be the more prominent organisms. Although the collected sputum specimens exhibited the same organisms, viridans streptococci were equally prominent. Organisms of the mixed variety could not be excluded, frequently being in predominence over those previously mentioned. The types of organisms seemed to vary with the source of the purulent discharge. For example, if infection was present in one of the nasal sinuses, hemolytic S. aureus was a common invader. This observation is in agreement with that of Goldstein and Daly,[8] who found the majority of the more chronic and extremely resistant sinus infections are caused by hemolytic S. aureus.

Comment and Conclusions

Since the introduction of antimicrobial agents they have been used freely in the treatment of nasal sinusitis and for the prevention of complications of operative procedures on the sinuses. Although these remedies have been utilized also for chronic purulent postnasal discharge, there have been few if any published reports of methodical studies dealing with their evaluation. It is for this reason in particular that the present investigation seemed justified. It should be stressed, however, that antimicrobial agents are advocated only as a supplement to basic indicated therapy.

The major consideration in this study was that of antibiotic specificity. The indiscriminate administration of antimicrobials is highly objectionable not alone because of probable therapeutic failures, but also because of the likelihood of provoking untoward reactions. Drug resistance is another factor which has to be considered.

Goldstein and Daly [8] emphasized that individual culture and sensitivity tests are absolutely necessary in evaluation and correct treatment of chronic ear, nose, and throat infections, and the present study substantiates their contention.

Finally, the management of chronic purulent postnasal discharge resolves itself into (1) the carrying out of indicated conventional procedures; (2) the administration of specific antimicrobial agents as supplemental therapy.

Summary

The implications of chronic postnasal discharge and chronic "postnasal drip" are different, and the one must be distinguished from the other to rationalize therapy.

Although some similarity exists in the mechanism and etiology of the two processes, the drainage product in chronic "postnasal drip" usually is nonpurulent.

In a study of 50 patients with chronic purulent postnasal discharge conventional therapeutic measures produced favorable results in only 10 of the patients (20%). With the supplemental use of specific antimicrobial agents, in the remaining 40 patients therapeutically uninfluenced by conventional measures, favorable effects were obtained in 24 of the patients (60%).

The results of this investigation demonstrated the significant value of antibiotic specificity—supplementing the conventional treatment of chronic purulent postnasal discharge with the administration of (specific) indicated antimicrobial agents.

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The Posterior Pharyngeal Flap Palatoplasty

Part II. Analysis of Twenty-Nine Patients

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The historical background, surgical technique, and indications for posterior pharyngeal palatoplasty were discussed in a previous publication.[1]

This is a preliminary report of the results obtained in 29 patients on whom this operation was performed. The patients ranged from 4 to 28 years of age at the time of operation. The average age was 10 years. Of these 29 patients, 18 were males and 11 were females.

The patients who had repaired cleft palates had an average lapse of 7.6 years prior to the pharyngeal flap operation. The extremes ranged from 3 months to 20 years.

The indications for the operation in our series can be summarized as follows:

1. Short palate in patients with previously repaired cleft palate—23 patients
2. Congenitally short palate associated with unrepaired cleft palate—2 patients
3. Congenitally short palate only—3 patients
4. Congenital paralysis of the soft palate—1 patient

There were five postoperative complications in this series, consisting of four partial and one complete separation of the flap. These patients were reoperated on without any further complications and with primary "takes" in each case. Three of these have not had speech evaluation since the second procedure.

Six patients who had primary successful surgical results have not returned for postoperative evaluation.

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Procedure

The patients who were subjects for this procedure had speech records made on permanent tapes pre- and postoperatively. If the surgery was not successful or if there was no discernible change in the speech pattern of any one patient, the postoperative recording was delayed until such time as speech change indicated a variation. The recordings for each patient were filed separately on individual reels, so that the preoperative recording was followed in immediate succession by the postoperative record. A comment by one of us (J. S.) describing the operative condition, patient's name, and date preceded each recording, so that the individual record and status were quickly and easily identified.

The speech of 20 patients of the original 29 yielded the following results on postoperative analysis: excellent, 7; good, 8; fair, 4; poor, 1.

The seven classified as excellent have been discharged with no residual speech defect.

Seven of the patients classified as good have been referred for speech therapy with a diagnosis of functional residual speech errors. On examination all of these patients could articulate every sound in isolation but had not learned to incorporate the proper usage of these in conversational speech. The prognosis for speech rehabilitation in these patients is good.

The eighth patient classified as good exhibited less nasality. This child, age 5 years, also had increased verbalization. Because of mental retardation it was not possible to attain an accurate articulation evaluation or to determine which factor was paramount in retarding language. Surgically he had an excellent result, and the prognosis for eventually obtaining adequate speech for his mental level is good.

The four patients classified as fair exhibited some speech improvement but were unable to produce some sounds even in isolation. Intensive speech therapy has been recommended for these, with a requested return for speech reevaluation at the termination of therapy sessions.

The patient with poor speech result had a successful pharyngeal flap but exhibited no speech improvement after one year. This patient will be reevaluated to consider other means of rehabilitation.

In summary, 29 patients had pharyngeal flap surgery to effect a more adequate nasopharyngeal closure. Seven of these have been completely rehabilitated. Seven have good surgical result, with residual functional articulatory speech problems, and are receiving speech therapy at the present time. One mentally retarded child has exhibited marked increase in verbalization postoperatively but no definitive speech measure has been possible. Four patients had limited speech improvement and will be reevaluated after intensive speech therapy. One patient had no speech improvement. Six patients had surgically successful procedures, but the resultant speech effect is not yet known. Three patients who had surgical failures were reoperated on, but resultant speech effect is unknown.

Conclusion and Comment

Approximately 50% of the patients who had pharyngeal flap surgery have either normal speech or sufficient improvement, exhibiting only functional errors, to warrant diagnosis as probable good language rehabilitation. Another 25% had some improvement and will have to be reevaluated after intensive speech therapy to judge the ultimate success of the surgery.

These results point to the need for continued investigation in this area. There is a need for more definitive speech evaluation both pre- and postoperatively with improved facilities for recalling these patients for adequate follow-up.

As stated originally, this is a preliminary report, and continued investigation has been planned.

Each patient will have exhaustive preoperative and postoperative examinations. Speech measures to be obtained will be recordings, a Templin articulation score, Ammons vocabulary test, 50 responses, lateral-cephalometric x-rays with the palate in position for phonation and at rest, and pressure measures. Pressure is obtained with a manometer which measures the ounces of oral pressure attainable with and without nasal occlusion. Vital capacity with and without nasal occlusion is also determined with a Vitalometer.

Each patient should be studied by a team formed by the otolaryngologist, prosthodontist, audiologist, psychologist, speech pathologist, and social worker if the patient is to receive proper management for the best possible rehabilitation.

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A New Approach to the Surgical Correction of Congenital Laryngeal Stridor

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This discussion applies to the surgical correction of that variety of congenital laryngeal stridor resulting from hypermobility of the epiglottis. This may be the result of defective morphology and/or excessive flexibility from softness of the cartilage. The patient has difficulty breathing from obstruction of the glottis by the epiglottis. This condition is usually intermittent. It is generally a self-terminating disease clearing by the age of 2 years. There are instances of this disease in which clearing failed to occur. There have been deaths resulting when stridor was complicated by an acute or chronic process.

Three procedures have been recommended for the treatment of severe cases—tracheotomy, amputation of the epiglottis, and trimming of the edematous aryepiglottic folds.[1-4]

Two severe cases were seen which required intervention. These were handled with a new technique not previously described. The simplicity and effectiveness of the treatment warrants its consideration by others.

The base of the tongue is clearly seen in doing tonsillectomy, with the Davis mouth gag, when the operator is seated at the head of the table looking down the throat. This exposure is best provided by hanging the gag so that the lower jaw is held above the line of vision of the operator as is done in suspension laryngoscopy. Extensive removal of the lymphoid tissue down into the vallecula can be performed when indicated.

It appeared to me that lingual tonsillectomy by the above approach could be slightly modified to encourage adhesion of the epiglottis to the base of the tongue. This is effected by continuing the lingual tonsil dissection to include the mucous membrane on the inferior two-thirds of the anterior surface of the epiglottis. The membrane can be stripped with relative ease. No diffi-

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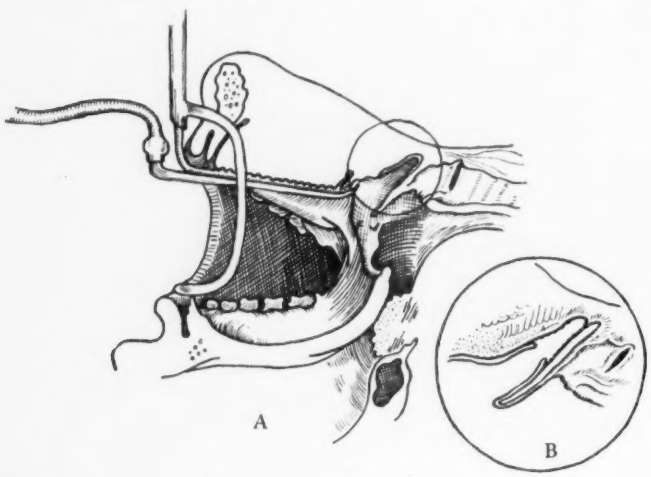

A, exposure of the vallecula by means of Davis mouth gag. *B*, enlargement of operative site showing extent of epithelial stripping.

culty from excessive bleeding was encountered. Rapid and effective adhesion of the opposing raw surfaces occurs. The epiglottis is thus maintained upright and prevented from falling into the glottal opening.

In order to obtain a good airway for anesthesia and to avoid any difficulty because of postoperative swelling of the larynx, a tracheotomy is done. The tracheal tube is left in place for approximately one week. In cases here reported no respiratory difficulty ensued.

The question of suturing the tongue to the epiglottis to promote adhesion of the two surfaces was considered, but it was not done since with the patient on his back adequate contact is obtained merely by the weight of the tongue.

Report of Cases

CASE 1.—A 2-year-old Negro boy with serious stridor since birth. This child was markedly undernourished. He had not been able to swallow solids because of unremitting, difficult, and rapid respiration. He had a rachitic-like deformity of his chest because of the chronic inspiratory retraction. X-ray of his chest showed no abnormality of lung, heart, mediastinum, or great vessels. The trachea was noted to be patent from the larynx to the carina. Radiopaque contrast material showed no abnormality of the esophagus and no communication between the esophagus and the trachea. On bronchoscopy the stridor disappeared with elevation of the soft, floppy, epiglottis. No abnormality of the cords, trachea or bronchi was seen. Operation as described above was performed, with immediate relief of symptoms, and the patient has been well to date, a period of two years.

CASE 2.—A 10-month-old Negro boy with congenital laryngeal stridor complicated by episodes of unconsciousness, probably petit mal seizures. During these intervals he developed extreme respiratory obstruction with severe cyanosis. It was the opinion of the pediatrician that these attacks endangered the child's life and that surgical intervention was necessary. Laryngoscopy revealed a soft hypermotile epiglottis with disappearance of the stridor when the cords were exposed. Tracheotomy and suspension of the epiglottis as previously described was done with relief of the stridor. One year has passed since the operation with no complications.

Summary

A simple effective surgical treatment for severe congenital laryngeal stridor is described.

51 Southgate Ave.

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Myringoplasty and Tympanoplasty—from Earliest Experiments to Present Techniques

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Plastic operations on the sound-conduction apparatus of the middle ear, like myringoplasty and tympanoplasty, are by now widely accepted, and attempts are under way all over the world to standardize the surgical techniques.[32] Only a few years ago these plastic operations emerged from a period of trial and error. It might, therefore, be timely to glance back at the rocky past of the new procedures, and to review their development from earliest experiments.

Closure of perforations of the tympanic membrane by means of a prosthesis was tried as early as 1640, when Marcus Banzer [3] used pig's bladder membrane stretched over an ivory tube as an artificial eardrum. More recently Hall [17] described a new type of prosthesis; he applied a 5% celluloid-in-acetone solution to jute paper before placing it over the perforation. An artificial eardrum, fashioned out of a rubber-like plastic, known as Korogel, was independently proposed by Pohlman [34] and by Sullivan.[40] Cautery of the edges of perforations, with or without patching, was the next step in the evolution of repair. According to Derlacki,[12] the first one to combine cautery with patching was Joynt, in 1919, and since that time various substances have been used for patching, particularly Cargile membrane,[5] cigarette paper, human amniotic membrane,[38] etc. If the first attempt at patching fails, repeated cautery may still result in closure of a central perforation of the tympanic membrane. Derlacki [12] modified Linn's [24] technique and reported success in a high percentage of cases, with an average hearing gain of 16.3 db. in the speech range.

Cauterization is a time-consuming office procedure requiring repeated visits. It is indicated only for perforations of moderate size, when the drum membrane is not too seriously scarred and the blood supply has remained satisfactory. In all other cases, particularly when the tear extends to the bony wall, it is preferable to apply a skin graft, or, in other words, to perform true myringoplasty.

Myringoplasty was first mentioned by Berthold [9] in 1879. In reporting success with the new operation he expressed the hope that the procedure might prove to be the sorely needed simple technique for the treatment of perforations of the eardrum. After controlling suppuration in the middle ear (not easy in those days) Berthold freshened the edges of the perforation and covered the gap with a piece of court plaster. Three days later this was replaced by a small split-thickness skin graft from the forearm. On the 18th postoperative day the transplant became detached, but the perforation was almost obliterated, and it closed completely in another two weeks. Hearing improved remarkably. Berthold made the following interesting remark: "Among the favorable factors which contributed to the success of the operation I would like to stress the extraordinary regenerative powers of the tympanic membrane, due to its abundant vascular supply. Furthermore, healing is favored by the undisturbed position of the transplant, superimposed as it is on the edge of the perforation. The temperature of the meatus, especially when it is packed, is subject to only minor variations. The transplant rests within a damp

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chamber, where desiccation will not take place." Subsequently Berthold experimented with other materials, particularly chicken egg membrane and rabbit cornea.[10]

Shortly therafter, other attempts at myringoplasty were undertaken by Ely[13] and Roosa, but failed to improve hearing. Three years later Tangeman[41] tried myringoplasty and succeeded in a patient with a large central perforation; the drum membrane healed, and hearing was for all practical purposes restored; yet there is neither a follow-up of the case, nor is there any record that Tangeman ever repeated the procedure. Berthold performed myringoplasty for at least 10 years, but his results did not convince the great majority of contemporary otologists. Politzer,[35] for instance, reported success in closing tears of up to 3 mm. in size; in larger perforations, however, the procedure failed, and therefore he considered myringoplasty on the whole as unsatisfactory.

These early experiments with myringoplasty were undertaken just before radical mastoidectomy was described and introduced by Kuester and Bergmann (cited by Mayer[27]) in 1889. There is no direct continuity between the attempts of Berthold and his followers, and myringoplasty as we know it today. During the intervening 60 years otologic surgeons were mainly occupied with improving the different variants of radical or modified radical mastoidectomy, and with the prevention of intracranial complications of acute and chronic otitis media.

After some years of experimentation with grafting, Wullstein[45] and somewhat later Zöllner felt that the time had finally come to revive myringoplasty. Owing to recent improvements in the surgical technique the operation could now be performed with greater safety, while at the same time antibiotic coverage had increased the chances for survival of the transplant. It would, however, seem that the most important factor in this development was the increasing emphasis on preservation of hearing. In the original radical mastoid operation pathologic processes had been eliminated—if necessary at the expense of function. The modified radical operation is an attempt to avoid sheer mutilation, but its indications remain very limited. With the revival of myringoplasty functional thinking has now been introduced into otology.

Wullstein[47] soon abandoned simple myringoplasty because he noted that hearing often failed to improve, even though to all appearances nothing more seemed to be required than closure of an uncomplicated perforation. In such cases, he concluded, there must have been an unrecognized disturbance of other portions of the sound-conduction system of the middle ear; therefore Wullstein now advocates tympanoplasty, Type I, which gives wide exposure and permits inspection and testing of ossicular chain and cochlear windows during the operation. Undoubtedly, however, many patients with perforated ear drums can still be rehabilitated by simple closure. Meanwhile the technique of myringoplasty has been further advanced by numerous otologists, of whom will be mentioned only Zöllner,[49] Pietrantoni and Bocca,[33] Ormerod and McLay,[30] and Beales[6]; a somewhat different technique of myringoplasty was independently developed by Frenckner.[14,15] House[19] performed surgical repair of the perforated eardrum, particularly after fenestration operation. Recently Wright,[44] experimenting with skin grafts of various thicknesses and taken from different donor sites, accomplished hearing improvement of 10-30 db. in 90% of patients. Pick[31] reported final take of the graft in 70% of cases.

Another function-preserving plastic procedure was developed by Wullstein[46] with the aim of replacing radical mastoidectomy in various types of chronic otitis media. For the new operation Wullstein coined the term *tympanoplasty*, but "plastic procedures of the sound conductive apparatus," as first suggested by Zöllner,[48] is probably more descriptive, indicating as it does a whole range of surgical techniques to cope with a variety of pathologic changes in the middle

ear. Of late the excellent term "audiosurgery" has been introduced by Antoli Candela Piquer.[1] The complex character of the new technique was well expressed by the late Kobrak[23] when meditating on the subject: "The surgeon must be audiologist, physiologist, plastic surgeon and experimenter, if he wants to work in tympanal plastic surgery."

Tympanoplasty as devised by Wullstein is the final outcome of new developments in various specialties, and a number of pioneering attempts preceded the plastic repair procedure in its present form. As far as we know, the first one to perform an operation which comes close to modern tympanoplasty was Kessel,[22] before 1887. The decisive passage reads: "In the case of circumscribed caries of the malleus, at the short process, I excise the ossicle; once the defect of the tympanic membrane necessitated by the operation has been replaced, an attempt is made to effect healing of the tympanic membrane to the crus of the stapes." According to Kessel, the operation was successful and hearing was improved. Reference to this case is made by Matte,[26] in a publication from the year 1901. He observed that some patients were able to hear better after mastoidectomy, provided remains of the drum membrane were in apposition to, or connected by, adhesions with the head of the stapes. Matte recommended excision of malleus and incus and exposure of the stapes, while preserving as much as possible of the tympanic membrane. The results were promising, and in several cases hearing remained considerably improved for a number of years.

Matte's technique has obvious similarities with the operation for which Juers[21] introduced the term myringostapediopexy. It is true, this procedure could be classified as a variant of myringoplasty, because the tympanic membrane is retropositioned in preference to application of a skin graft; but myringostapediopexy goes beyond simple myringoplasty in that it utilizes the columella action. One year prior to Juers' publication Wullstein[46] suggested that in cases of this kind the columella effect be established by applying a free-skin graft to the stapes, a procedure which is now known as tympanoplasty Type III of Wullstein.

In another passage Matte seems to anticipate the "small tympanum": "The healed tympanic membrane seals off a new, small, air-containing tympanic cavity from the exterior meatus, while the bony spaces above are epidermized and in constant contact with the outside air." But after this isolated communication he never pursued the subject any further.

Another observation in line with what we now call the "small tympanum" was made by Dr. Charles R. Weeth of Brooklyn. In a personal communication to Zwerling[51] he states that "if the tympanic-wall scar tissue was elevated by inflation of the Eustachian tube, a pseudotympanic cavity might ensue with freedom of the stapes and the round window membrane. Periodic inflation may be necessary and sometimes no benefit accrues; often, however, there results useful hearing in an otherwise fixed non-hearing ear." Weeth had practiced this method for several years prior to 1952. In spite of all these interesting experiments and observations the real suggestion for the "small tympanum" came from Moritz.[28] He developed a plastic operation in which a pedicle graft from behind the ear is used to reestablish the phase difference between oval and round window. This type of repair will in suitable cases reduce the conductive hearing loss by 12-20 db.

The success of any plastic operation depends on the survival of the graft. Already Berthold[10] noticed that the transplant receives its nourishment from the granulating mucosa. In his very first paper[9] on myringoplasty he reports that after 18 days a part of the transplanted skin was sloughed off, while underneath the drum had healed. Apparently it was the superficial epithelial portion of the skin graft which had been shed, while the deeper subcuticular layers were retained. Similar observations can be made by any one who practices this type of

surgery. With regard to the role of the transplant, Burian [11] developed the theory that the graft represents only a place-securing factor, forming a scaffold until new tissue grows and organizes in the ever-decreasing reticulum of the free graft. This is one of the reasons why some authors, including me, believe in the superiority of the full-thickness graft. Burian went still one step further and suggested the use of preserved skin.

Primary skin grafting in the middle-ear cavity was originally introduced with the aim of promoting healing, and later on to improve hearing after mastoidectomy. Early experimental attempts are described by Sir Charles A. Ballance,[2] who himself made great contributions to the art of grafting. Apparently the first one to use a skin transplant in the United States was E. M. Plummer, and in his footsteps was H. P. Mosher,[29] who reported in 1911 mobilization of a pedicle flap of postauricular skin to fill the greater part of the mastoid cavity. Harris and Meadows [18] reviewed the further development of skin grafting of mastoid cavities, and successfully applied split-thickness transplants taken from the anterior surface of the arm. While Hagan [16] proposed a two-step procedure, Jones [20] showed that under combined systemic and topical antibiotic coverage skin grafting can be successfully performed at time of radical operation. Zwerling [51] obtained definite hearing improvement by primary skin grafting at the end of mastoidectomy. Wright [44] concluded that survival of the transplant depends on a number of factors: complete control of infection; careful readying of the graft bed; proper selection and preparation of the graft, and, finally, light packing, which permits good contact while avoiding undue pressure. At the present time skin transplants taken from various sites and in various thicknesses are being used, and reference is made to the latest review of the subject by Zöllner.[50]

There were other factors which contributed to the development of modern plastic operations of the sound-conduction mechanism of the middle ear: the discovery of the antibiotics, the introduction of the dissecting microscope, and the steady refinement of diagnostic and operative techniques. Still all these achievements might have remained without practical significance for the treatment of nonotosclerotic conductive deafness. It is of decisive importance that at the same time great strides were made in the understanding of the physiologic acoustics of middle and inner ear, which developed mainly in connection with the fenestration operation.

The gross anatomy of the middle ear had been described by the great Italian anatomists of the 16th century; somewhat later the alternative ossicular and air routes to the inner ear windows as well as the movements of the spiral ligaments were recognized. But it was not before 1941 that Békésy [8] arrived at accurate measurements of the motion of various parts of the drum membrane in response to sound stimulation; his findings have become the basis for the evaluation of perforations in various parts of the drum membrane, and have contributed to the understanding of the acoustic principles with which successful repair must comply.

It has also been demonstrated that one of the functions of the ossicular chain is to shield the inner ear against overstimulation and damaging intensities of sound. This protection is lost when the articulating ossicular chain is replaced by a single connecting link, which in reptiles and birds is known as the *columella*. Columella transmission retains the hydraulic pressure ratio (based on the difference between the surface areas of tympanic membrane and footplate of the stapes); but as the lever action of the ossicular chain cannot be recovered there will be a hearing loss of 2.5-3.0 db. Thus a scientific basis has been gained for such operations as myringostapediopexy and several variants of tympanoplasty.

Maybe the most interesting aspect of plastic operations on the sound conductive apparatus of the middle ear is recovery of hearing through reestablishment of the

phase difference. The interaction between oval and round window had been demonstrated as early as 1874, by Mach and Kessel.[25] Following the classical experiment of Bárány [4] and the observations by Békésy,[7] Wever and Lawrence [43] succeeded in clarifying the functions of the round window; in particular, new light was thrown on the phase difference between sound transmitted along the ossicular route and sound reaching the round window by way of the air in the middle ear. Finally, Ranke, Keidel, and Weschke [36] showed that movements of the basilar membrane depend on the ability of the round window membrane to vibrate. .. With a better understanding of the importance of phase difference and mobility of the round-window membrane the decisive function of the air space in front of the round window has come clearly into focus. The alternative air route to the cochlea through the round window was discovered as early as the middle of the 16th century, but only modern physics and recently developed surgical techniques succeeded in clarifying the issue. Several variants of tympanoplasty are designed to manipulate the air spaces within the middle ear, and we now speak of "airspace pathology" [23] and its correction. Thus the theoretical and experimental foundations were laid for what has been rightly called "surgery of the round window," or creation of a small tympanum, and for the indispensable diagnostic procedures, especially use of the sound probe of Zöllner before and during operation.[42]

Tympanoplasty is indicated in a wide range of pathologic conditions affecting the middle ear. Yet it is most frequently resorted to in the treatment of chronic otitis media, in the correction of adhesive deafness, and in the rehabilitation of denuded middle-ear cavities following earlier radical mastoidectomy. With regard to these indications there is still another line of development which leads up to present-day tympanoplasty—the steadily growing recognition of the importance of early operation for the prevention of unnecessary damage to the sound-conduction system. Soon after radical mastoidectomy had been introduced as a life-saving operation otologists began to experiment with modifications designed to protect hearing, especially in those cases where both ears were involved. An important step was the so-called *conservative radical operation,* which to a certain extent may be considered a forerunner of tympanoplasty. Schoenemann,[37] who suggested this term, stressed the desirability of modifying the radical operation, so that conductive hearing might be protected or occasionally even improved. Once a technique had been developed which permitted eradication of disease without disturbing the ossicular chain, surgery could be performed early, before the development of irreparable damage and complications.[39] Tympanoplasty is the latest step in the attempt to protect or improve conductive hearing in patients with middle-ear disease. If it should prove impossible to preserve drum membrane and/or ossicular chain, plastic procedures are now available which in the great majority of cases permit reconstruction of a highly efficient sound-conduction mechanism.

Summary

Ingenious experiments with what we now call myringoplasty and tympanoplasty were begun long before the turn of the century. Yet it took generations of patient work in such seemingly unrelated fields as aural prostheses, patching of the drum membrane, cautery, grafting, and particularly clarification of the acoustics of middle and inner ear before it became possible to devise present-day myringoplasty and tympanoplasty. These new plastic procedures are highly flexible and may be of great benefit in a wide variety of pathologic conditions of the middle ear—always with the ultimate aim to protect or restore function.

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Micrognathism Corrected by Vertical Osteotomy of the Ascending Ramus and Bone Chips

A New Technique: A Preliminary Report

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Introduction

Many surgical procedures have been proposed for the correction of mandibular micrognathia. The very numbers show that there exist inherent possible difficulties in all of them. The open vertical osteotomy of the ascending rami with iliac bone graft chips is offered as a new procedure which overcomes many past difficulties.

Method

Accurate dental models are mounted on an anatomical articulator in an arbitrary postoperative position. Intermaxillary relationship alone dictates this position. A small acrylic splint is made to cover the occlusal and incisal edges of the teeth. A day or two before surgery Erich type arch bars are placed on the maxillary and mandibular arches of teeth.

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Surgery

An incision approximately 5 cm. in length is made approximately 1 cm. below the angle of the jaw. The skin subcutaneous tissues and platysma muscle are divided with a knife. Beneath the platysma muscle an electrical nerve stimulator is used to identify the mandibular branch of the facial nerve, which is retracted upward. The periosteum at the lower border of the mandible is incised. The periosteum is then elevated from the lateral surface of the ramus. After the mandibular notch is definitely identified, a nasal saw (Fig. 1) is placed, and an osteotomy is made from the deepest portion of the notch to the angle of the mandible.

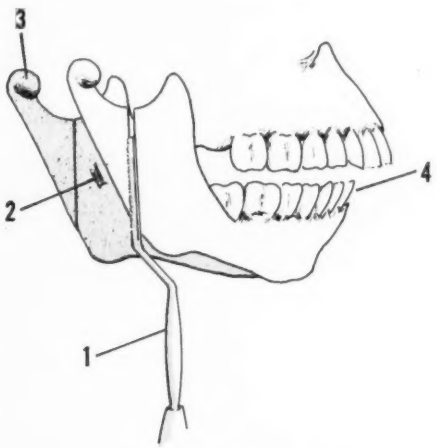


Figure 1

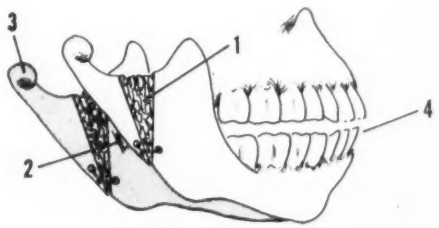


Figure 2

Fig. 1.—Drawing of retruded mandible. (1) Saw in position for vertical osteotomy. (2) Mandibular foramen. (3) Condyle. (4) Malocclusion due to micrognathia.

Fig. 2.—Drawing of mandible after surgery. (1) Iliac bone graft chips in surgical defect. (2) Mandibular foramen. (3) Condyle. (4) Corrected occlusion.

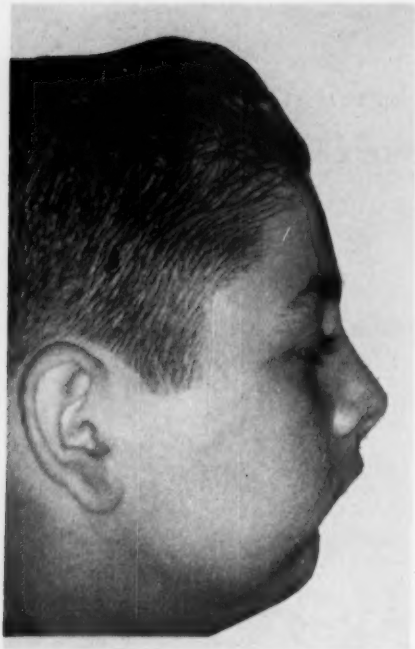


Fig. 3.—Preoperative photograph taken May 25, 1957, showing micrognathism.

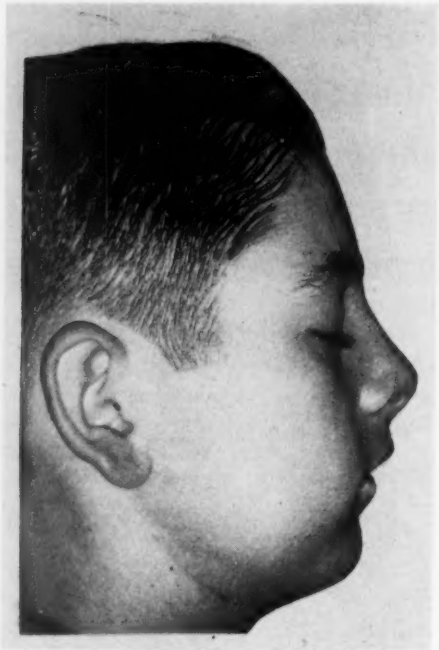


Fig. 4.—Postoperative photograph taken Oct. 12, 1957, showing improvement in appearance.

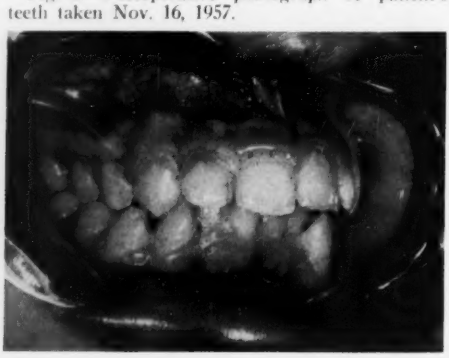
When both sides have been divided the body of the mandible is brought forward to the predetermined position and immobilized by intermaxillary wires over the occlusal splint. The proximal fragment is then slightly rotated so that the inferior border of the proximal fragment approximates the inferior border of the distal fragment at the osteotomy sight. Holes are drilled in each fragment and an interosseous wire placed. This leaves a V-shaped defect in the continuity of the mandible. The defect is then packed with iliac bone graft chips (Fig. 2). The wound is closed. The jaws remain immobilized for approximately 12 weeks.

Report of a Case

A 16-year-old white boy was referred by his orthodontist for surgical correction of his mandibular micrognathia. On June 15, 1957, Erich type

Fig. 5.—Preoperative photograph of patient's teeth for comparison with Figure 6.

Fig. 6.—Postoperative photograph of patient's teeth taken Nov. 16, 1957.



arch bars were placed on the maxillary and mandibular arches of teeth. On June 18 the surgery previously described for micrognathia was performed at the Santa Monica Hospital. On Sept. 21, 1957, the intermaxillary wires were removed, and the following day the arch bars were removed. The patient made an uneventful recovery. He was last seen on Jan. 18, 1958. There had been no change in the occlusion. Roentgenograms showed normal healing. The patient had no complaints.

Comment on the Method

Reconstructive surgery should be reserved for those severe cases in which conservative dentoalveolar correction with a graft to the chin is not sufficient. In the reported case further improvement could be obtained by a chin graft. The site of osteotomy is physiologically correct as it does not separate the powerful muscles of mastication from the denture area where the stresses are borne. The slight pull of the external pterygoid muscle is not great when the jaws are immobilized, and this pull is also controlled by the interosseous wire at the lower border of the osteotomy site.

Summary

A method of open vertical osteotomy of the ascending rami with iliac bone chips is presented as a surgical procedure in the correction of micrognathia. A case using this method is presented. No conclusions can be drawn from one case. This patient will be examined from time to time for a follow-up of this preliminary report.

The Salts Derived from the Combination of Streptomycin and Neomycin with Glucuronic Acid

The First Experimental Research on the Antibacterial Power and Ototoxic Effects of These Salts

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Streptomycin

The neurotoxic effects of streptomycin (given in the form of sulfate or hydrochlorate) on man's cochleovestibular structures, noted first by Brown and Hinshaw [4] in 1946, were confirmed later by many other experimental and clinical observations. It was thus possible to ascertain that streptomycin has an elective neurotoxic action on the structures connected with the vestibular branch of the eighth nerve, while such electivity appears less noticeable on structures connected with the cochlear branch of the same nerve.

Streptomycin causes pathological lesions on peripheral cells having highly differentiated specific functions. Only the alterations of the vestibular system are subject to functional compensations of central nature with the passing of time, though the pathological damage still remains unaltered. The acoustic damage must be considered irreversible both morphologically and functionally.

Submitted for publication Aug. 9, 1958.

The salts of streptomycin and neomycin with glucuronic acid used in these experiments were prepared, in accordance with the directions of G. Rossi and A. Olivieri, by A. Gay, B. S., Chemist, Assistant at the Pharmacological and Toxicological Institute, University of Turin.

From the Otolaryngologic Clinic, University of Turin; Prof. F. Brunetti, Director (Dr. Rossi, Otologist), and the Institute of Pathology, University of Turin; Prof. G. Mottura, Director (Dr. Olivieri, Pathologist), in collaboration with the Institute of Physiology, University of Turin, A. M. Di Giorgio, Director.

Therefore cochleovestibular lesions caused by streptomycin do not seem to be affected by any therapeutic treatment.

Dihydrostreptomycin synthesis was the first trial made for the purpose of preventing streptomycin toxic effects. Dihydrostreptomycin proved scarcely toxic on vestibular structures; it possessed, however, a remarkable neurotoxic electivity on structures connected with the cochlear root of the eighth nerve, causing, in many instances, irremediable damage to man's hearing function. Therefore, in connection with the great production on an industrial scale of dihydrostreptomycin, La Société Internationale d'Audiologie (The International Society of Audiology) during its Convention in Paris on Jan. 22-23, 1955, approved a resolution aimed at "calling physicians' attention to the danger of serious deafness caused by doses, even very slight, of dihydrostreptomycin." "The Society advised that this medicine be used only according to precise directions."

During a long series of experimental studies trial was made of giving streptomycin at the same time with other substances which might have had an antidotal action (vitamin A—Escher and Rupp [11]; Tschirren [40]; vitamin B—Aubertin [1]; Kluyskens and van Lindt [18]; Catalano and Madonia [7]; Hennebert [14]; Rossi [30]). The results which were obtained, however, did not permit transfer on a clinical level of the data obtained from studies on animals, and this for many reasons.

With the aim of reducing toxic effects of streptomycin, keeping unaltered its anti-

bacterial properties, attention was then turned to the synthesis of new streptomycin salts. Among these particular study was made of the behavior of streptomycin pantothenate (Keller, Krüpe, Sous, and Muckter [17]) and streptomycin phosphorylate (Riskaer, Christensen, Petersen, and Weidman [29]). These two compounds showed actually less neurotoxic effect compared with the common salts available, such as streptomycin sulfate (other salts, previously synthesized, such as streptomycin hydrochlorate, had already proved more toxic than the sulfate), but the lessening of neurotoxic effects was keeping pace with the lessening of antibacterial power.

While following these researches, we resolved to experiment with the behavior of streptomycin salts with glucuronic acid, and this idea was taken into due consideration not so much because this acid has in vitro antibacterial properties (Wooldridge and Mast [48]), has very few acute toxic effects (Deichmann and Hopfenspirger [9]), and facilitates weight growth in animals (Reid [28]), but rather because it is used by the organism in its protective synthesis to annul toxic effects from many products of exogenous and endogenous metabolism, making their elimination possible through the kidneys.

Streptomycin glucuronate had already been prepared by Mast [24] in 1949, but it was tried only to ascertain whether it retained any therapeutic property in a few cases of nontuberculous infections of the urinary system.

On the favorable characteristics of streptomycin glucuronate [32] we shall comment in the experimental part of this paper.

Results obtained in experiments with dihydrostreptomycin glucuronate [31] will be reported in detail in another paper.

Experimental Research

A. Hematic Absorption and Degree of Acute Toxicity.—Hematic absorption was studied on rabbits after subcutaneous administration of 15 mg/kg. (as the base). Hematic rates were determined by Mitchison and Spicer's method.[25] The diagram lines obtained proved the two salts may be superimposed.

The study of acute toxic degree was carried out by valuating the LD_{50} through antibiotic intraperitoneal administration to albino rats.

The LD_{50}, calculated according to Thompson and Weil's [39] statistical method, was as follows: streptomycin sulfate, 745 mg/kg (as the base); streptomycin glucuronate, 934 mg/kg (as the base).

B. Study of Antibacterial Power in Vitro and in Vivo.—The antibacterial activity of the preparation of streptomycin glucuronate was studied in vitro and in vivo with reference to that of streptomycin sulfate.

1. Study of Antibacterial Power in Vitro: The study was carried out by the evaluation of the antimicrobic and the microbiostatic action of streptomycin sulfate, compared with that of streptomycin glucuronate.

By the method of gradual broth solutions, repeated controls of gradual concentrations of streptomycin glucuronate and sulfate were carried out (intervals between concentrations of antibiotic were 0.1μg.; 10 samples for each concentration) on cultures in Difco broth of various groups of Escherichia coli; Klebsiella pneumoniae; Staphylococcus aureus, s. Oxford; Salmonella typhimurium, and on cultures in Dubos media (without polysorbate 80 [Tween 80]) of Mycobacterium tuberculosis H_{37} RV.

The minimum and maximum values of the minimum inhibitory doses for each bacterial group in the large number of trials carried out are shown in Table 1.

Other experiments were carried out on the comparative activity of the two streptomycin salts in various concentrations on the development of E. coli 95 I. S. M.

The statistical elaboration of the data obtained through the photometric reading of the darkening and expressed as optical density, revealed the difference between the lines obtained by the two

TABLE 1.—*Study of Antibacterial Activity of Streptomycin Sulfate and Glucuronate*

Bacterial Strain	Streptomycin Sulfate μg/Ml.	Streptomycin Glucuronate μg/Ml.
E. coli 95, I. S. M.	2.10-2.50	1.90-2.30
E. coli Lab. Prov. Ig., Torino	2.00-2.30	2.20-2.40
K. pneumoniae (Hyg. Inst., Zurich)	1.60-1.80	1.60-1.90
S. typhimurium, Ist. Pat. Gen., Torino	7.20-6.80	6.80-7.40
S. aureus, var. Oxford, I. S. M.	0.45-0.60	0.40-0.55
M. tuberculosis H_{37}RV, I. S. M.	1.00-1.40	1.00-1.40
M. tuberculosis H_{37}RV (Hyg. Inst., Zürich)	0.50-0.80	0.50-0.85

salts of the antibiotic with no meaning, but due only to chance.*

2. Study of Antibacterial Power in Vivo: The study of the antibacterial power in vivo was carried out in four groups of experiments on guinea pigs and albino rats. In the first group of experiments we studied comparatively the antibacterial activity of the two salts in experimental infection from S. typhimurium through intraperitoneal injection in albino rats; in the second and third groups of experiments we studied the antibacterial activity of the two salts in experimental infection from M. tuberculosis H_{37} RV injected in guinea pigs subcutaneously in the left inguinal fold; in the fourth group of experiments we studied experimental infection from M. tuberculosis in albino rats by venous injection.

In the first and fourth groups of experiments the antibiotic was given in the dosage of 20 mg/kg/day; in the second group of experiments in the dosage of 40 mg/kg/day; in the third group of experiments in the dosage of 30 mg/kg/day. The general condition of the experimental animals was evaluated; their weight increase as well as their survival rate. All the animals, both those which died during the experiments and those which survived and then were killed after the end of the experiments, underwent autopsy control.

Macroscopic and histologic pathological studies were made on various organs, and, for one of the groups also bacteriological examinations.

During our experiments with streptomycin glucuronate we have always remarked a definite increase in the survival of the animals, compared with the controls. The increase rate was always parallel with, and at times higher than, that of the animals treated with streptomycin sulfate. Similarly, with regard to the diffusion and the entity of the pathoanatomical lesions, a constant analogy was found between the findings drawn from the animals treated with streptomycin sulfate and those treated with glucuronate, while the general condition and trophism of the latter always proved better than the former and than the controls.

The data drawn from the survival and the macroscopic and histologic pathoanatomical studies of the various groups revealed unaltered the antibacterial activity of streptomycin glucuronate in the experimental infections we examined.

C. Study of Functional and Pathological Effects on Cochleovestibular Structures. — Functional Study: A functional study of the effects of streptomycin sulfate and glucuronate was carried out in two groups of experiments.

In the first group of experiments, which lasted 220 days, the antibiotic was given in the dosage of 50 mg/kg/day (as the base) in two daily administrations by subcutaneous injections. In this group, experiments were also made on the effects of dihydrostreptomycin sulfate on cochleovestibular structures. In the second set of experiments, which lasted 21 days, the antibiotic was given in the dosage of 200 mg/kg/day (as the base) in two daily administrations by way of subcutaneous injections. Weight and survival were carefully controlled, and the otolithic reflexes were studied (compensatory reactions of the eye, head-erection reflexes, linear-acceleration motions). Ampullar reflexes were studied by means of rotary trials both with free and with immobile body, galvanic and thermal trials (warm and cold). The hearing function was studied by evaluating Preyer's reflex (auricle reflex).

Results of Functional Study

Weight of Animals.—Streptomycin sulfate impeded weight growth rather remarkably in both groups of the experimental animals, compared with the controls. On the other hand, weight growth was scarcely affected in the animals treated with glucuronate, so much so that in the first experimental group the weight growth after over seven months was equal to that of the control animals. Dihydrostreptomycin sulfate also impeded the weight growth of the animals to which it was given, though the hindrance was less than in those treated with streptomycin sulfate.

Ampulla Reflexes.—Streptomycin sulfate caused in all the animals a clear and marked vestibular hypoexcitability, which, in many cases, reached the stage of areflexia. In all the animals treated with streptomycin glucuronate, the labyrinthine reflex remained normal, with the exception of two animals of the second group, in which a moderate hypoexcitability of the labyrinth was evident. Dihydrostreptomycin sulfate produced in some of the animals of the first

* The statistical elaboration was done by Prof. Diego de Castro, Director of the Istituto di Statistica of the University of Turin.

group a moderate bilateral hypoexcitability of the labyrinth.

Otolithic Reflexes.—Streptomycin sulfate in a high percentage of guinea pigs produced a reduction in intensity and range at the starting point of the macula acustica and the saccule. The otolithic reflexes in the animals treated with streptomycin glucuronate showed only in a very moderate percentage (and only in the second group) a slight decrease in the intensity and range of the reflexes, compared with the controls made before starting the experiments. Very slight was the reduction of the reflexes observed in the animals which were treated with dihydrostreptomycin sulfate.

Auditory Function.—No one of the animals treated with streptomycin glucuronate showed any threshold increase in the Preyer reflex. About one-fourth of the animals treated with streptomycin sulfate showed a threshold increase for this reflex or disappearance altogether of this reflex. All the animals treated with dihydrostreptomycin sulfate showed instead, according to frequency, remarkable threshold increase of Preyer reflex and in many cases disappearance of the reflex.

Results of Pathological Study

In all the animals the following were examined in serial sections: pars petrosa, pons, medulla oblongata, cerebellum.

From the whole of our observations carried out in the two groups of experiments with different dosage and different length of treatment, we could observe in the animals treated with streptomycin sulfate a constant damage of the neuroepithelial structures of the vestibular apparatus, parallel with an affection of the rhombencephalon structures.

However, we must point out that the lesions were distributed discontinuously in the anatomic regions examined and with different degrees of intensity according to the treatment used.

Comparing histologic examinations carried out in the two groups of experiments, we have constantly observed more remarkable affections of all the vestibular structures in the animals treated with the dosage of 200 mg/kg/day (as the base).

Concerning hearing structures, the point of greatest interest in the histologic findings is the fact that while with the dosage of 50 mg/kg/day (as the base) only degenerative phenomena were shown affecting ganglial structures and terminal nuclei of the eighth nerve, with the dosage of 200 mg/kg/day (as the base) there also appeared regressive lesions affecting the neuroepithelial receptors of Corti's organ.

Streptomycin sulfate showed elective neurotoxic action only on structures connected with the two roots of the eighth nerve. The nuclei of origin of the other cranial nerves appeared normal.

The animals treated with streptomycin glucuronate in the two groups of experiments never revealed any appreciable morphological lesions affecting vestibular and cochlear neuroepithelial receptors. Concerning actual nerve structures, only with very high daily dosage (200 mg/kg/day) and only in two animals, did degenerative lesions appear of very moderate degree affecting some cells of the vestibular ganglion.

No one of the animals treated with streptomycin glucuronate in these two groups of experiments showed phenomena of regressive order affecting the terminal nuclei of the vestibular root of the eighth nerve and the cochlear root of the same nerve.

Conclusions

From the whole of the results obtained, we can conclude that the glucuronate of streptomycin, in the treatment of experimental infections, has a therapeutic activity of degree equal to that of the sulfate of streptomycin. Compared with streptomycin sulfate, the neurotoxic action of the streptomycin glucuronate on the cochleovestibular apparatus, in the experimental trials we carried out, appeared very slight and negligible.

Neomycin

Neomycin, isolated in 1949 by Waksman and Lechevalier [42] from a culture of Streptomyces fradiae, is a white substance, soluble in water, insoluble in organic solvents, formed from a mixture of three antibiotics named neomycin A, B, and C. The chemical and biological properties of this new antibiotic have been studied in detail by Waksman et al.[38,43-47]; Karlson et al.[16]; Knight et al.[19]; Felsenfeld et al.[12]; Hobby et al.[15]; Bernard and Kreis [2]; Cantarella [5]; Lund and Skadlauge [23]; Bogen et al.[3]; Lazar and Fishman [20]; Lazar and Goldin [22]; Lazar, Goldin, and Auerbach [21]; Prigot et al.[26,27]; Schatten et al.[37]

The active antimicrobic spectrum of neomycin takes in mostly gram-negative organisms (coli, Friedländer, Shigella, Salmonella, Brucella, Proteus vulgaris, Pseudomonas aeruginosa, etc.). Among the gram-positive bacteria, the staphylococcus is particularly sensitive to this antibiotic; in addition, neomycin has a notable action with regard to the M. tuberculosis and the Actinomyces.

The use of neomycin by the parenteral route has always been contraindicated by the secondary toxic effects that this antibiotic has on the kidneys and the auditory function. These secondary toxic effects have been pointed out by Waisbren and Spink [41]; Carr et al.[6], and Duncan et al.,[10] all in the clinical field. In the experimental field, the research of the following workers must be remembered with regard to this problem: Waksman and Lechevalier [42]; Hawkins and Lurie [13]; Rüedi, Graf, and Tschirren [36]; Riskaer et al.,[29] and Costa.[8]

With the goal of preventing the ototoxic effects of neomycin, Tschirren [40] proposed the use of vitamin A, while Keller et al.[17] and Riskaer et al.[29] have tried to reduce the ototoxic effects by means of the synthesis of new salts (respectively neomycin pantothenate and phosphorated neomycin). These salts produced a diminished neurotoxic effect with respect to the commercial salt, neomycin sulfate. However, with a reduction of toxicosis, a corresponding reduction of antibiotic power was also noted.

On the basis of what has already been observed with regard to streptomycin, we prepared a salt derived from the combination of a neomycin base with glucuronic acid.[33] The considerations that have guided us in the selection of glucuronic acid are expounded in works regarding the possible prevention of ototoxic effects of streptomycin by means of a combination streptomycin base with glucuronic acid. The reader is referred to these works for further details.[31,32,34,35]

The scope of this work has been to investigate the antibiotic and ototoxic powers of the neomycin glucuronate, as compared with the commercial preparation, neomycin sulfate. Therefore, the scope is the possible prevention of the ototoxic and nephrotoxic effects of neomycin by combining it with glucuronic acid.

Experimental Research

A. Acute Toxicity.—The study of acute toxicity has been carried out by evaluation of the LD_{50}, with intraperitoneal administration in the white rat. The LD_{50}, calculated according to the statistical method of Thompson and Weil, was as follows: neomycin sulfate, 178 mg/kg. (as the base); neomycin glucuronate, 252 mg/kg. (as the base).

B. Study of Antibacterial Power in Vitro and in Vivo.—1. Study of Antibacterial Power in Vitro: The antibacterial power in vitro was studied by determining the minimal inhibiting dose of the two salts in question on the following bacterial strains: E. coli (Hyg. Lab., Turin); S. typhimurium (Inst. of Gen. Path.-Turin); S. aureus var. Oxford I. S. M.; M. tuberculosis H_{37} RV (Hyg. Inst., Zurich).

The minimum and maximum values of the minimal inhibiting doses for each strain tested are shown in Table 2.

In addition, tests of microbiostasis were carried out for a comparative evaluation of the effects of the two salts in various concentrations on the growth of Escherichia coli 95 I. S. M.

The statistical elaboration of data obtained by photometric reading of the turbidity and expressed as optic density demonstrated that the difference obtained between the curves of the two salts of the antibiotic has no bearing and is due only to chance.

2. Study of Antibacterial Power in Vivo: The comparative study of the two salts was performed

TABLE 2.—*Antibacterial Activity of Neomycin Sulfate and Glucuronate in Vitro*

Bacterial Strain	Neomycin Sulfate μg/Ml.	Neomycin Glucuronate μg/Ml.
E. coli 95 I. S. M.	0.50-0.70	0.60-0.80
E. coli Hyg. Lab., Turin	0.40-0.60	0.50-0.60
S. typhimurium Inst. Gen. Path., Turin	3.50-4.00	3.50-4.10
S. aureus var. Oxford I. S. M.	0.02-0.03	0.02-0.03
M. tuberculosis $H_{37}RV$ — Hyg. Inst., Zürich	1.00-1.40	1.00-1.45

in vivo on three groups of 28 white mice, all males, and weighing from 16 to 20 gm. All animals were inoculated by the intraperitoneal route with 0.5 ml. of a 10-hour broth culture on Difco of S. typhimurium I. S. M. From the date of inoculation, the various groups were treated for two days as follows:

First group—neomycin sulfate, 15 mg/kg/day (as the base) in two daily subcutaneous injections

Second group—neomycin glucuronate, 15 mg/kg/day (as the base) in two daily subcutaneous injections

Third group—physiological solution, 1 ml. in two daily subcutaneous injections.

The observation period lasted 120 hours, beginning at the moment of inoculation.

The quantity of micro-organisms inoculated proved to be lethal in the space of 120 hours in all the animals of the control group.

A marked increase in the survival time was observed in the animals treated with neomycin sulfate and neomycin glucuronate; 120 hours after the inoculation 10 animals from the group treated with the sulfate salt of neomycin were still alive, and 8 from the group treated with the glucuronate salt.

C. Study of Functional and Pathological Effects on Cochleovestibular Structures.—1. Functional Study: The functional study of the effects of neomycin sulfate and neomycin glucuronate on the cochleovestibular structure, were carried out on two experimental groups of guinea pigs, all males.

In the first group of experiments which lasted 21 days, the antibiotic was given in the dose of 120 mg/kg/day (as the base) in two daily subcutaneous injections. In the second group of experiments, which lasted 90 days, the antibiotic was given in the dose of 20 mg/kg/day (as the base) in two daily subcutaneous injections.

The weight and the survival of the animals were recorded and the otolithic reflexes studied (optocompensatory reactions, straightening of the head reflexes, movements of linear acceleration). The ampulla reflexes were studied by means of the rotation test with free and fixed body, the galvanic test, and the hot and cold thermal tests. The auditory function was studied by determining the threshold values for the Preyer reflex (rebending of the auricula) at frequencies of 2,000, 4,000, and 8,000 cps.

2. Pathological Study: All the animals of the first group of experiments were killed at the termination of the experiments.

Three animals of every group belonging to the second group of experiments were killed at the termination of the experiments. The other animals were kept alive for future testing of the auditory function.

In all the animals killed, serial sections were made of the following: pars petrosa, pons, medulla oblongata, cerebellum. Also samples taken from the liver and kidney of every animal were examined. References made here pertain to data collected from the first group of experiments. The histological specimens of the second group of animals are still in preparation at this writing.

Results of Functional Study

Weight of the Animals.—The neomycin sulfate seriously impeded the weight growth in the animals of the first group of experiments, while the neomycin glucuronate had a less detrimental action on the weight growth of the animals. In the second group of experiments, the weight growth in the different groups of guinea pigs was scarcely influenced by the antibiotics. In fact, after 90 days of experiments, the difference between the average weight of 100, was contained within modest limits.

Ampulla Reflexes.—Among the animals of the first group of experiments, there was observed in 7 of the 14 animals a discrete, bilateral, labyrinthine hyporeflexia with the rotation test, at the end of the experiment. These guinea pigs belonged to the group treated with neomycin sulfate. The data deduced from the rotation test were then confirmed by the galvanic and thermal tests.

None of the animals of the first group of experiments treated with neomycin glucuronate presented, at the end of the experiments, modifications of the vestibular reflectivity, with respect to the checks carried out at the beginning of the experiments. In the second group of experiments no

modifications in the vestibular reflectivity were noted, either in the animals treated with neomycin sulfate or in those treated with neomycin glucuronate.

Otolithic Reflexes.—Only in a small number of guinea pigs in the first group of experiments with neomycin sulfate treatment, was there observed at the end of the experiments a distinct reduction in the intensity and width of the otolithic reflexes, as compared with the check made at the beginning of the experiments. In the animals in the first group of experiments treated with neomycin glucuronate, and in all the animals of the second group of experiments, no variations were ever observed, as compared with the preliminary controls, in the intensity and width of the otolithic reflexes.

Auditory Function.—In the first group of experiments, it was impossible to provoke the Preyer reflex at a frequency of 8,000 cps in any of the animals treated with neomycin sulfate at the end of the series of experiments. In the group treated with neomycin glucuronate, the abolition of this reflex, at the same frequency, occurred at the same moment, but in only 6 of the 14 animals treated.

At the end of the experiments, the Preyer reflex was present at the frequencies of 4,000 and 2,000 cps in all of the animals treated with neomycin glucuronate, while in the animals treated with neomycin sulfate, the reflex was absent in 9 out of 14 at a frequency of 4,000 cps, and absent in 5 out of 14 at a frequency of 2,000 cps.

In the second group of experiments, the abolition of the Preyer reflex at a frequency of 8,000 cps was noted in 9 of the 10 animals treated with neomycin sulfate. For frequencies of 4,000 cps and 2,000 cps the reflex was abolished respectively in 7 out of 10 animals and 4 out of 10 animals treated with neomycin sulfate.

At the end of 90 days, none of the animals treated with neomycin glucuronate presented modifications of threshold values or abolition of the Preyer reflex at the above-mentioned frequencies.

Results of Pathological Study

The animals treated with neomycin sulfate showed serious alterations of the two nuclei connected with the cochlear root of the eighth nerve. In the dorsal cochlear nucleus the dendrite cells almost completely disappeared, while Nissl's degeneration was observed in the cells of the ventral cochlear nucleus. In animals treated with neomycin glucuronate no appreciable histological lesions were encountered in the nuclei connected with the cochlear root of the eighth.

At the level of Corti's ganglion, all animals treated with neomycin sulfate presented a grave numerical reduction of the neuronal cells with proliferation of the ectoglia. These facts, particularly accentuated at the level of the passage point between the basal gyrus and the second gyrus, were observed along the entire course of the spiral ganglion. A moderate numerical reduction of neuronal cells was encountered in the guinea pigs treated with neomycin glucuronate, only at the passage zone between the basal and second gyrus. In all other sectors, the spiral ganglion appeared morphologically intact.

In the animals treated with neomycin sulfate, Corti's organ appeared destroyed at the level of the basal gyrus and in part of the second gyrus. When observations were made at the level of the superior gyrus, serious degenerative alterations of the ciliated cells were noted, particularly of the external ones, which often appeared grouped in amorphous blocks of intense chromophilic substances.

In the animals treated with neomycin glucuronate, degenerative alterations were observed only in the external ciliated cells, limited exclusively to single sectors of the basal gyrus. Corti's organ appeared morphologically intact in all other sectors.

Few manifestations of albuminoid or vacuolar degeneration were noted at the level of the contorted tubules of the first order in the kidneys of animals treated with neomycin sulfate. Instead, serious alterations of the hepatic parenchyma were noted in these animals.

Here the hepatic cells were in the process of grave vacuolar degeneration, while the degenerative changes in animals treated with neomycin glucuronate were few.

Conclusions

The results obtained in this series of experiments justify the statement that neomycin glucuronate demonstrates, in experimental infection, a therapeutic action similar to that of neomycin sulfate. In addition, we may state that the neurotoxic effect of neomycin glucuronate on the cochleovestibular structure, in our experiments, has been noticeably less than that of neomycin sulfate.

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Nota I—Il problema dell'azione neurotossica della streptomicina nei suoi aspetti clinico, anatomopatologico, sperimentale, terapeutico ed impostazione della ricerca sperimentale.

Nota II—Caratteristiche chimiche del glucuronato di streptomicina.

Nota III—Studio comparativo fra l'attività antibatterica in vitro del solfato di streptomicina e del glucuronato di streptomicina con osservazioni sulla tossicità acuta (LD_{50}) e sull'assorbimento ematico dei due sali.

Nota IV—Studio comparativo fra l'attività antibatterica in vivo del solfato di streptomicina e del glucuronato di streptomicina.

Nota V—Studio funzionale comparativo degli effetti del solfato di streptomicina e del glucuronato di streptomicina sulle strutture cocleo-vestibolari.

Nota VI—Studio anatomopatologico comparativo degli effetti del solfato di streptomicina e del glucuronato di streptomicina sulle strutture cocleovestibolari.

Nota VII—Considerazioni conclusive.

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The Retroauricular Pedicle Skin Graft for Tympanoplasty After a Radical Mastoidectomy

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Hitherto, the main purpose of a radical mastoidectomy has been to eradicate infectious foci of the mastoid cells and the middle-ear cavity and to prevent intracranial complications. The recent trend is not only to accomplish exenteration of necrotic bone but also to preserve the existing subnormal hearing or even to improve it to a serviceable level, depending on the integrity of the cochlear potential.

To achieve such a desirable goal, the most important problem is the creation of an air-containing "new" middle ear, permanently open, aerated by a patent Eustachian tube and covered by a hermetically sealed substitute tympanic membrane capable of vibrating to transmit the sound waves by way of the movable stapes.

Among the pioneers on tympanoplasty, Bell [1] cited the works of Ombredanne, Wullstein, and Zöllner for the plastic reconstruction of the destroyed membrana tympani and the middle ear to fulfill the favorable conditions for the restoration of hearing. Ombredanne utilized a thin free graft to dry up a radical cavity and noticed an excellent hearing gain. Zöllner placed the graft in apposition with the capitulum of the stapes, which served as an adequate substitute for the membrana tympani and transferred the sound directly to the head of the stapes. He also adapted the flap to the upper half of the medial wall of the cavity so that the round window would be able to function properly in a smaller, yet intact, tympanic cavity. Wullstein attempted to attain a closed tympanum, capable of vibration, with a drum containing air, ventilated from the Eustachian tube to the fenestra rotunda with a thin full-thickness graft approximately 1 mm. in thickness and lined with absorbable gelatin sponge tampons. He observed the so-called "columella effect," wherein improvement of hearing occurred when the tympanic membrane or free graft was placed in contact with the head of the movable stapes, but requiring an adequate air space and a membrane capable of vibration.

The last two requirements are essential because in the transformation of sound pressure, on the way to the labyrinthine fluid the proportion is 1:22; only the smallest part is apportioned to the lever transmission of the chain of auditory ossicles (1:1.3); by far the largest part falls to the surface condition of the tympanic membrane to the base of the stapes (1:17), so replacement by "columella" means little unless one succeeds in establishing as large a vibrating surface as possible within the transplant.

Rambo [2] found that there is not enough tissue in the vicinity of the middle ear to carry out any extended repair, and invariably the skin graft from the thigh bridging the middle-ear cavity becomes attached to the promontory by fibrosis, thereby defeating the essential requirement of maintaining a permanent air space and a vibratory membrane. He devised a rather complicated plastic procedure, employing a pedicle flap from the temporal muscle to support the pedicle skin grafts of the external ear canal to avoid obliteration of the newly created middle-ear cavity. The third stage of his operation is fenestration, which is beyond the scope of this paper.

The sole purpose of this paper is to show a simple plastic repair of the middle ear

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after a radical mastoidectomy with the preservation, or even improvement, of hearing by fulfilling the fundamental conditions enunciated above. Since 1956 I [3] have employed a retroauricular pedicle skin graft to line the radical mastoid cavity mainly to hasten the healing of the denuded space and produce a dry ear in a shorter time, without realizing its tympanoplastic usefulness. This graft is a pedicle remaining attached at its upper end, ample, viable, with adequate nutrition, resistant to infection, a sure take, and very simple to perform.

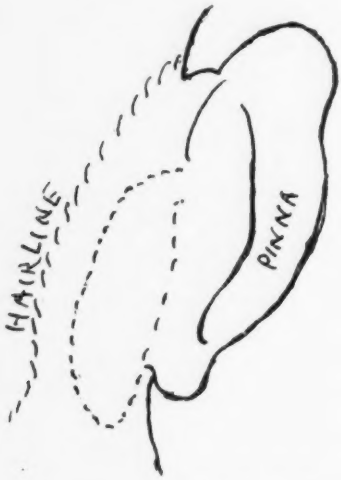

Fig. 1.—Dotted lines indicate retroauricular pedicle skin-graft incision.

After the mastoidectomy by the endaural approach, the graft is fashioned as follows: The first incision starts about the level of the floor of the external meatus at the posterior attachment of the pinna, following its curvature downward to the back of the lobule or even lower as desired. The second parallel incision behind starts at the level of the roof of the meatus, curving downward, even extending up to the hair line, depending on the width of the graft necessary. Below, the two parallel incisions are joined by a curved incision. The distal third of the graft is dissected by knife to make it as thin as possible (the portion to cover the cavum tympani) while the proximal two-thirds is dissected by scissors only for

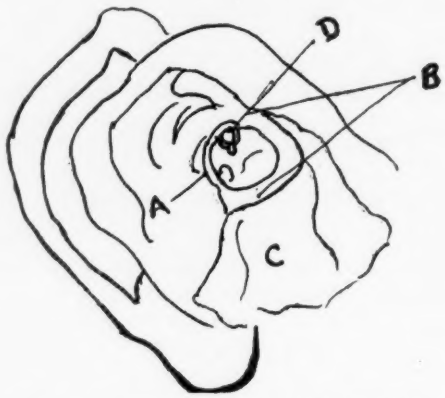

Fig. 2.—Exenterated mastoid. *A*, bridge of bone left in place. *B*, bone near annulus denuded of skin. *C*, remnant of ear canal skin. *D*, exposed stapes.

faster work and need not be thin, as it will line the mastoid cavity. The tongue of skin is inserted through a buttonhole made in the remaining connective-tissue attachment of the pinna and spread out in the mastoid cavity and over the middle ear.

The classical mastoidectomy is modified a few steps. On removal of the osseous posterior canal wall, the bridge of bone at the annulus is trimmed very thin and left in place, the anterior aspect curetted if necessary to expose the head of the stapes, as is done in stapedolysis to promote adhesion of

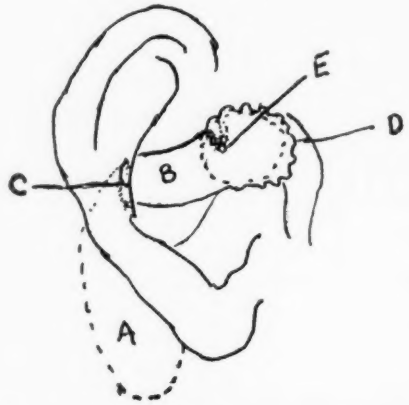

Fig. 3.—Graft in place. *A*, bed of graft. *B*, graft passed through buttonhole. *C*, *D*, margins and tip of graft apposed to denuded space near annulus. *E*, graft in contact with head of stapes.

the graft to the stapes and attain the columella effect (tympana stapediopexy of Juers[4]). The bridge is left in situ intentionally to act as support for the graft and prevent its future adhesion to the promontory. The entire posterior third of the cutaneous ear canal is excised from the meatus to the annulus to give space for the graft. The circumference of skin near the annulus is denuded so that the tip of the thinned graft can be apposed to the bony wall, up, anteriorly, and below, outward like a cuff. Absorbable gelatin sponge (Gelfoam) is inserted in the middle ear to support the tip of the graft from falling against the promontorium. The cavum tympani, including the tympanic end of the Eustachian tube, is cleaned very gently with gauze and small forceps, no curettage, to preserve whatever healthy mucous membrane is left. A 1 in. long, narrow petrolatum gauze strip is used to invaginate the graft against the head of the stapes and left in place for 10 days. A second long strip is for packing the mastoid cavity and is removed only after five days.

Report of Cases

The majority of cases seen in the office are all secondary to chronic suppurative otitis media of long years' standing and submit only to surgery when there is an acute exacerbation with severe pain, or when there are symptoms of labyrinthine involvement, as nystagmus and dizziness, or when the headache becomes unbearable owing to impending intracranial complications. Hence, most of the patients are poor subjects for successful hearing rehabilitation and many will need fenestration to attain a serviceable hearing level. However, a 40 to 50 db. hearing loss, below the ideal useful 30, allows the patient to get along fairly well in life, not very severely handicapped.

CASE 1.—A young man of 17 years, whose middle ear suppuration started when he was 2 years old, had aural polyps protruding at the external auditory meatus. The preoperative hearing level was between 70 to 80 db., which improved to 40.

CASE 2.—A young woman of 23, suffering from otitis media since she was 7 years old, had septic temperature, constant headache, dizziness, and nystagmus. Preoperative audiogram showed 60 db. hearing loss, which improved to between 35 and 40.

CASE 3.—A young girl of 13, with otitis media since infancy, with subperiosteal abscess twice incised through the years elsewhere, had cholesteatoma and postauricular fistula. The preoperative level of 70 db. was improved to the 40 to 50 level.

Summary

Three cases are reported in which hearing improved moderately after modified radical mastoidectomy and tympanoplasty with the use of the retroauricular pedicle skin graft.

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Audiology Section

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On the Detection of Extremely Small Changes in Sound Intensity

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A number of investigators [1-19] have recently reported that certain kinds of hearing loss are apparently accompanied by unusually keen differential sensitivity to intensity. Their studies indicated that, in hearing loss due to cochlear lesion, the patient was able to discriminate smaller intensity changes than a listener with normal hearing. Furthermore, many of these investigators made the assumption that the apparent reduction of the intensity difference limen was due to the presence of loudness recruitment in the affected ear. On the basis of this assumed causal relationship, it was proposed that the measurement of the intensity difference limen afforded an indirect test for the presence of loudness recruitment. A normal-sized difference limen was thought to imply the absence of recruitment, while an abnormally small difference limen was interpreted to indicate the presence of recruitment.

Some investigators have failed to confirm these observations. Studies by Liden and Nilsson [20] and Lund-Iversen [21] suggested that the intensity difference limen was not effective in differentiating among types of hearing impairment. More recently, the well-controlled study of Hirsh, Palva, and Goodman [22] attacked both the empirical and the theoretical framework underlying the clinical utilization of the intensity difference limen as an indirect test of loudness recruitment.

These authors demonstrated that differential intensity sensitivity failed to distinguish patients with recruitment from patients without recruitment, or from persons with normal hearing. They went on to point out the logical fallacy inherent in the notion that the difference limen will be reduced as a consequence of an abnormally steep loudness function (recruitment) by noting that this belief rests on the now-disproved assumption that all difference limina are subjectively equal.

As a result of these conflicting reports some confusion exists relative to the clinical value of the various tests designed to assess differential intensity sensitivity.

It is our belief that much of this confusion can be clarified by the recognition of two fundamental considerations. First, it is important to distinguish carefully between the *observation* that some patients seem to be able to hear remarkably small changes in sound intensity, and the *theory* that there necessarily exists a unique relationship between the size of the intensity difference limen and the slope of the loudness function.

In other words, recognizing, with Hirsh et al., the theoretical argument that the presence of loudness recruitment does not necessarily imply a reduction in the difference limen need not materially affect the situation. The fact that early attempts to explain the observations of abnormally

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acute differential sensitivity in terms of the loudness recruitment phenomenon were obviously naïve does not alter the significance of the observation that certain patients (generally those with loudness recruitment) are often able to detect smaller intensity changes than normal ears at comparable levels above threshold.

The apparent correlation between loudness recruitment and abnormally keen differential intensity sensitivity is subject to many interpretations. It may be entirely fortuitous and coincidental; it may be due to an inherent relationship between the two phenomena of which we are yet only dimly aware, or, as one of us[23] has previously suggested, both phenomena may derive from some more basic parent disorder. While a final answer to this problem would be of extreme interest from the viewpoint of auditory theory, the question is largely irrelevant from the viewpoint of auditory diagnostic tests. For the present, the important question is whether the patient's ability to discriminate small changes in sound intensity is related either to site of lesion within the auditory mechanism or to any kind of meaningful pattern of diagnostic categories, not whether the measurement of differential sensitivity provides an indirect test for the presence of loudness recruitment.

A second important consideration to be borne in mind is that the observation of what looks like abnormally acute sensitivity to small changes in sound intensity may have very little to do with the difference limen for intensity in the classically defined sense. Stated differently, we may be dealing with a disorder or function which merely simulates an abnormally small difference limen, and then only under certain conditions. In view of the multiplicity of variables known to affect the conventional measurement of the difference limen in normal ears, it seems conceivable that any one of a number of changes in the functional state of the ear could bias the measurement in a particular direction in some methodologies but not in others. For example, it may be that behavior simulating abnormally acute differential sensitivity will arise only through the use of a test methodology involving relatively sustained stimulation. At the same time, the patient's intensity difference limen might be entirely normal when defined by a methodology not involving sustained stimulation (e.g., the method of constant stimulus differences).

This consideration implies that the *exact methodology* employed to assess differential sensitivity may be of more critical importance than has been heretofore assumed. In our opinion, it is highly possible, and not in the least heretical, to suppose that patients with cochlear lesion will manifest behavior simulating abnormally keen differential sensitivity only when the measurement is performed in a particular and unique manner.

With the above considerations as a frame of reference, we undertook, late in the fall of 1956, the development of a new methodology for the clinical assessment of differential intensity sensitivity. The purpose of the present report is twofold: first, to describe this new methodology; second, to present typical findings obtained through its application to patients with various types of hearing loss.

Rationale for New Methodology

The fundamental principle guiding the development of the new technique was our belief that the key to a successful method in this area lay in the use of relatively sustained rather than interrupted stimulation of the test ear.

Within this context of sustained stimulation an attempt was made to devise a method that would overcome the limitations of previous techniques. These limitations are well known to all who have attempted to measure the intensity difference limen in clinical patients. They appear to derive from two primary sources: first, extreme variability in the responses of the same patient from trial to trial; second, lack of

reliability among different testers of the same patient. It is our belief that a substantial portion of these difficulties may be traced to one factor, the temporal pattern of the test stimulus.

In the DL tests originally proposed by Lüscher and Zwislocki [11-14] and Jerger,[8,9] the test stimulus was a continuous, fixed frequency tone, amplitude modulated at 50% duty cycle, at the rate of 2-3 cps. To the listener, this temporal pattern takes the form of a "wobbling" or "beating" sound, and the clinical task is to determine the degree of amplitude modulation necessary to produce the "beating" attribute in the auditory sensation. It seems likely that this aspect of the test situation poses a serious limitation for two reasons: first, determining when a tone is just perceptibly "beating" is an extremely difficult judgment even for the most sophisticated listener; second, the inclusion of this kind of judgment in a clinical test inevitably results in a response measure susceptible to the subjective interpretation of the tester.

The task of designing a new procedure was therefore approached with two goals in mind: first, to employ a stimulus whose temporal pattern would not require a "beating" judgment; second, to make the test procedure as objective as possible by limiting the number of decisions required of the tester.

To meet these goals, the basic temporal pattern used in the quantal psychophysical method [24] was adopted. In this method, short amplitude increments are superimposed on a signal of constant amplitude at relatively widely spaced intervals. The patient's task is to respond whenever he hears a momentary change in the loudness of the steady signal. The tester's task is merely to record the presence or absence of a response to the presentation of each increment. The method is thus characterized by (1) the use of relatively sustained stimulation over time; (2) a simplification of the patient's task by complete avoidance of a "beating" judgment, and (3) simplification and objectification of the tester's role in the procedure.

Apparatus

In the present test sequence an increment occurred once every five seconds. Each increment rose to maximum amplitude in 50 msec., remained at maximum amplitude for 200 msec., then decayed to the steady-state level in 50 msec. The size of each such amplitude increment was exactly 1 db.

Figure 1 shows a simplified block diagram of the apparatus originally used to produce this signal. The output from an audio-oscillator was split into two channels. In the lower channel, the signal passed through a fixed attenuator and a manual switch to a mixing network. In the upper channel, the signal passed through an electronic switch (Grason-Stadler, Type 829-S), through a variable attenuator, then to the mixing network, where it was combined with the signal from the lower channel. The combined output from the mixing network passed through a second variable attenuator to an impedance-matching transformer, then to an earphone (Permoflux, Type PDR-10) mounted in an MX41/AR cushion.

With the switch in the lower channel closed, the signal at the earphone consisted of the steady-state tone from the lower channel and the superimposed increments periodically added to the steady-state level by the electronic switch. An interval timer triggered the switch so that it passed the signal for 300 msec. (50 msec. rise-decay time, 200 msec. at maximum amplitude) once every five seconds. The variable attenuator (A_1) in the upper channel controlled the amplitude of the increment, while the variable attenuator beyond the mixing network (A_2) controlled the level of the composite signal. This apparatus was used until August, 1957. Since that time a modified commercial audiometer has been employed for all measurements.

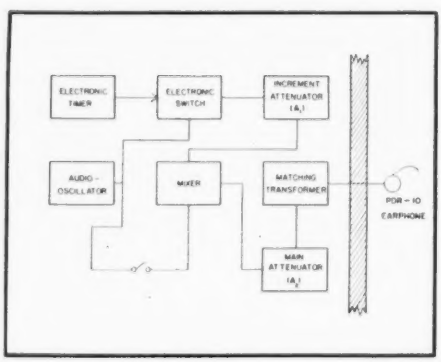


Fig. 1.—Simplified block diagram of experimental apparatus.

The initial design of the procedure was guided by the desire to construct a task so difficult that subjects with normal differential intensity sensitivity could not perform it with any degree of success. To this end, an increment magnitude of 1 db. and a presentation level 10 db. above the subject's threshold were initially chosen. Subsequent experience suggested, however, that 10 db. may have been unnecessarily low. Even at levels of 30 to 40 db., the task is sufficiently difficult, and the extreme faintness of the 10 db. tone makes the procedure somewhat frustrating for patients with a conductive loss. In view of these considerations, a sensation level of 20 db. was later adopted. The difference between results obtained at the two levels was found to be minimal. Accordingly, in the remainder of this paper, no distinction is made between results obtained at the two levels.

Test Procedure

Instructions to each patient were as follows:

"You will hear a steady sound in your ear for about two minutes. The sound will be very faint. During the time it is on you may occasionally hear a little jump in loudness. Whenever you are quite sure that you have heard one of these short loudness jumps, press the button which you have in your hand. If you *think* you heard a jump but you are not certain, then do not press the button. Only press it when you are *sure* you heard a jump in loudness."

When the patient indicated that he clearly understood these instructions, the tester adjusted the composite signal to the desired level above the patient's threshold, adjusted the increment to the desired magnitude, and turned on the signal in the patient's earphone.

A complete test run involved the presentation of 28 increments. The first five increments were each 5 db. in magnitude and served only to familiarize the patient with the task by presenting increments that could easily be heard. After this initial practice period the magnitude of the increments was reduced to 1 db., and the actual test run, consisting of the presentation of 20 one-decibel increments, commenced. In order to guard against the possibility of either false-negative or false-positive responses, three additional increment presentations were interspersed with the 20 test increments as follows. After five 1-db. increments had been presented and responses scored, the sixth increment was altered according to these rules:

1. If the subject had responded to two or less of the five increments, the sixth increment was set to 5 db.

2. If the subject had responded to three or more of the five increments, the sixth was set to 0 db.

This procedure was continued throughout the test run, i. e., after the 5th, 10th, and 15th 1-db. increments, the next increment was either increased to 5 db. or removed entirely. In other words, if the patient was not responding to the majority of 1-db. increments, a relatively large 5-db. increment was periodically introduced in order to keep his attention mobilized and to be sure that he continued to understand the test instructions.

If, on the other hand, the patient was responding to a majority of the 1-db. increments, an increment was occasionally removed in order to be sure that his responses were to the increments and not to the rhythmic five-second sequence. Responses to these three "catch" items were not included in the final score. The sensitivity index was computed solely from responses to the 20 one-decibel increments.

Method of Reporting Results

All results have been expressed in terms of the percentage of 1-db. increments to which a correct response was made. The resultant score is termed a "short-increment sensitivity index" (SISI). Thus, a patient who responded to 10 of the 20 increments received a SISI score of 50%, etc.

A convenient method for charting test results is to plot, graphically, the SISI score in per cent versus frequency, using the conventional symbols, "O" for the right ear and "X" for the left ear. It is useful to represent frequency on the abscissa and SISI on the ordinate. The resultant graphic representation is called a "SISI-gram." Examples are shown in Figures 2 through 7 of the present paper. The shaded area between 0 and 10% represents the approximate range of scores to be expected in normal ears.

Results

Administration of SISI to a wide variety of hearing-impaired subjects has revealed interesting patterns of response. In general, purely conductive losses yield very low scores, while losses presumed to be localized in the sensory structure of the inner ear

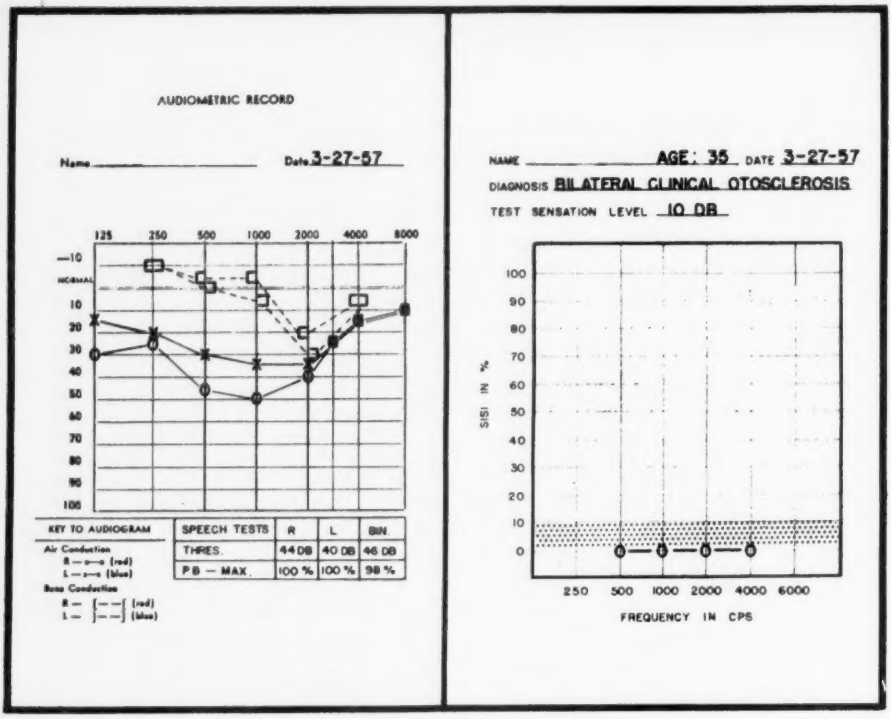


Fig. 2.—Audiogram and SISI-gram of patient with early otosclerosis.

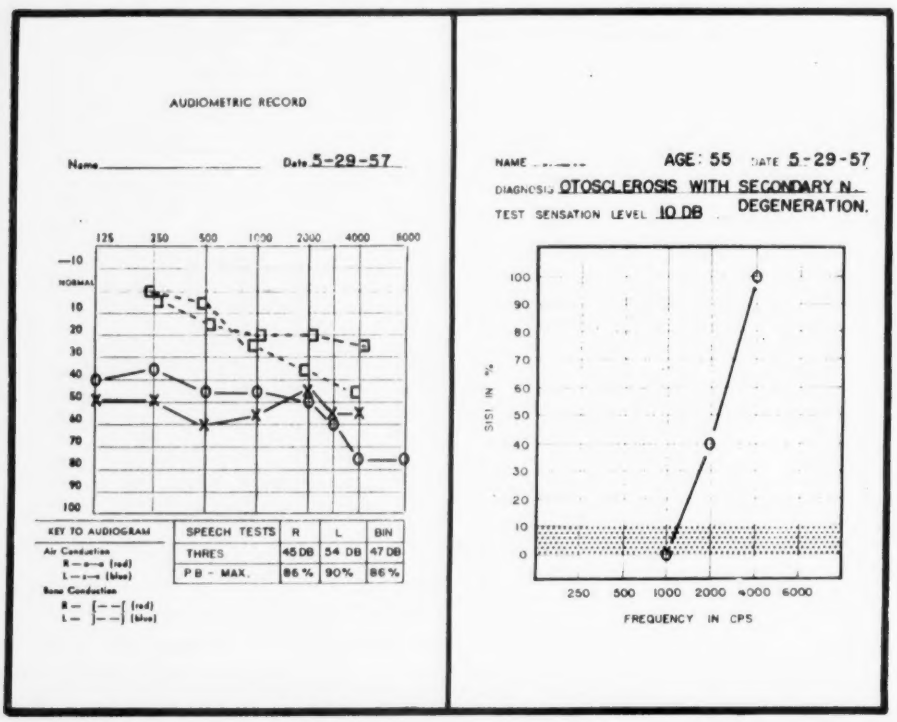


Fig. 3.—Audiogram and SISI-gram of patient with otosclerosis accompanied by secondary sensorineural loss.

tend to show very high scores. Values between these extremes are infrequent. When they do occur, they are observed most commonly in presbycusis. The following cases illustrate these generalizations more concretely.

Figure 2 shows the audiogram and SISI-gram of a 35-year-old white woman with early otosclerosis. The air-conduction audiogram shows the stiffness tilt characteristic of otosclerosis, the bone curves show the "Carhart notch" at 2,000 cps, and discrimination for PB words is unimpaired. The patient did not respond to a single increment at any of the four test frequencies.

Figure 3 illustrates typical findings in a later stage of otosclerosis. Both air- and bone-conduction thresholds show a slight fall-off at high frequencies, and the PB score shows a discrimination loss of 14%. The SISI score is low at 1,000 cps but rises to 40% at 2,000 cps and to 100% at 4,000 cps. In other words, the slight sensorineural loss at high frequencies, suggested by the conventional audiometric findings, is reflected in the SISI-gram.

Figure 4 illustrates results typical of losses presumed to be cochlear in origin. Here the loss in acuity is due to excessive noise exposure and is sharply localized to frequencies about 3,000 cps. Monaural bi-frequency loudness matching (Reger Test) and alternate binaural loudness matching (Fowler Test) indicated the presence of loudness recruitment at 4,000 cps. SISI results illustrate the relatively high scores obtained in presumably cochlear lesions with recruitment.

Because of the sharpness of the drop in the half octave between 3,000 and 4,000 cps, SISI performance was explored at closely

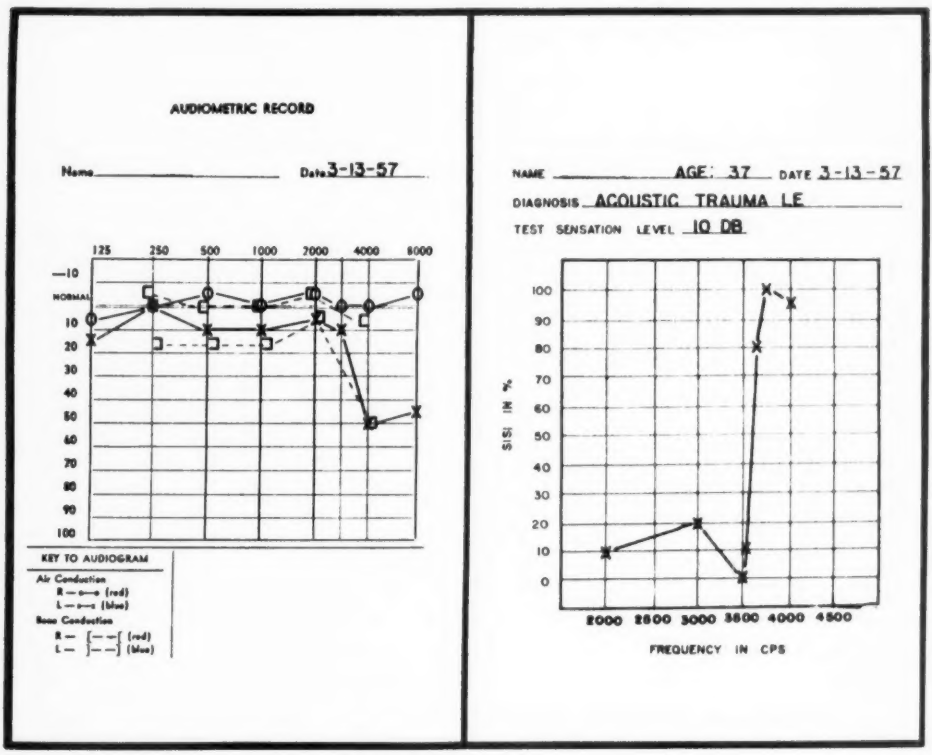


Fig. 4.—Audiogram and SISI scores of patient with noise-induced loss.

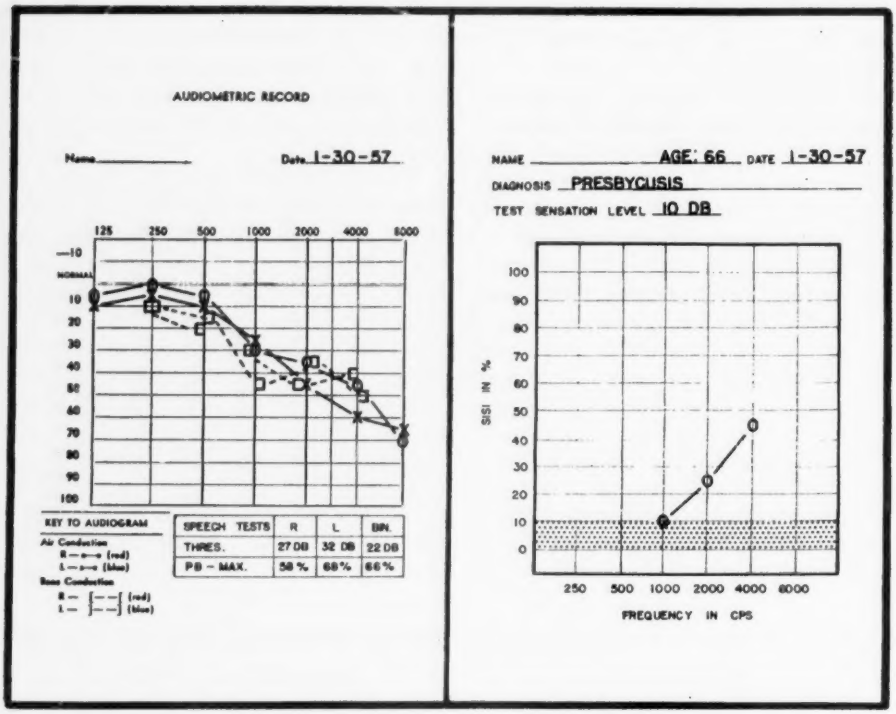


Fig. 5.—Audiogram and SISI-gram of patient with presbycusis.

spaced frequencies in this region. Note that scores are quite low out to 3,550 cps. Within the next 50 cycles, however, the score increases to 80%. Finding it difficult to accept such evidence of radically different functioning within a span of only 50 cycles, we repeated the test at each frequency and obtained virtually identical results, with a maximum variation of only 5%. This evidence of a sharp change in the SISI score within a relatively narrow span of frequencies has been observed in several subsequent cases of noise-induced loss. The break seems to occur at a frequency somewhat above the point at which the audiometric curve levels off after its descent. This would appear to be a finding worthy of further exploration in other types of loss.

Figures 5 and 6 typify findings in presbycusis. In Figure 5 the SISI score increases gradually from 1,000 to 4,000 cps, but never exceeds 45%. In Figure 6, on the other hand, the score jumps from only 10% at 2,000 cps to 90% at 4,000 cps. Presbycusis appears to be a clinical entity in which the SISI score is quite unpredictable. It is invariably low at frequencies below 1,000 cps. Above 1,000 cps, however, three distinct patterns may emerge. The SISI score may continue to be relatively low at all frequencies; it may rise gradually to an intermediate value of about 40%-50%, as illustrated in Figure 5, or it may rise sharply to a high level (90%-100%), as illustrated in Figure 6.

Figure 7 summarizes findings in a case of presbycusis with a superimposed labyrinthine hydrops on the right ear. SISI scores on the left ear are similar to those in Figure 5. On the right, or hydrops, ear, however, performance is totally different. Here, SISI scores are relatively high, even at very low frequencies.

It is worth while to pause and reflect, momentarily, on these last findings. Note that when the right, or hydrops, ear was

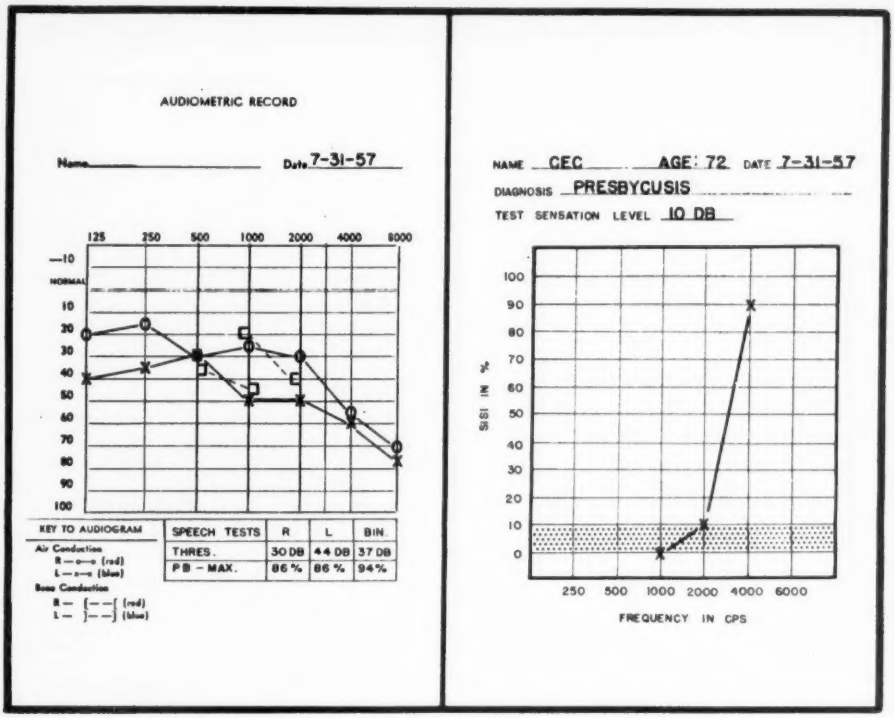


Fig. 6.—Audiogram and SISI-gram of patient with presbycusis.

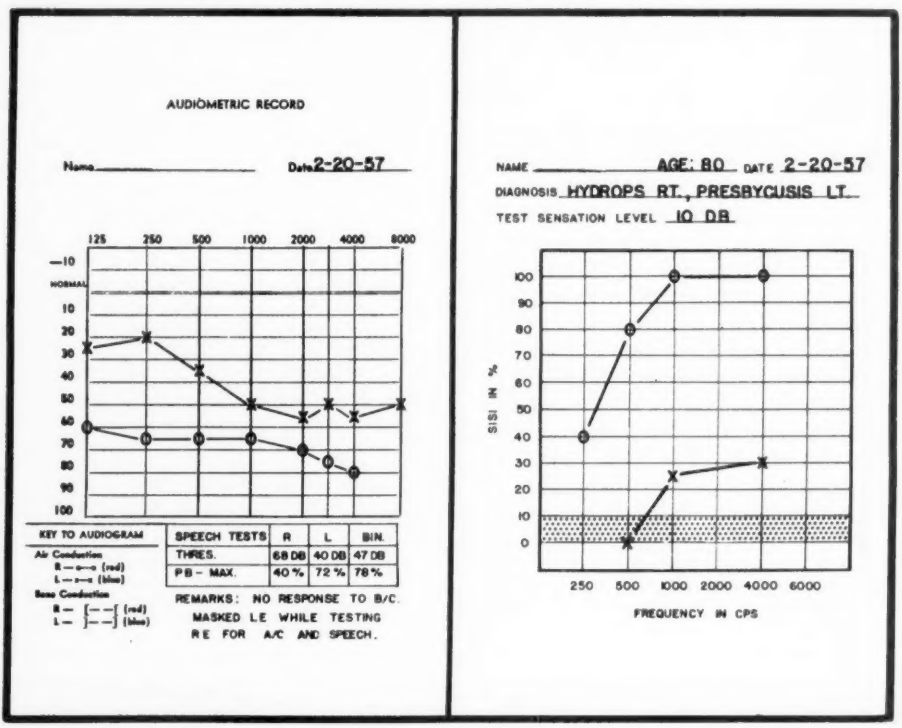


Fig. 7.—Audiogram and SISI-gram of patient with presbycusis and superimposed unilateral labyrinthine hydrops on right ear.

TABLE 1.—*Summary of SISI Results at 1,000 and 4,0000 cps in Seventy-Five Patients with Various Types of Hearing Loss*

Type of Loss	No.	Range of Hearing Loss at 1,000 Cps, Db.	Range of Hearing Loss at 4,000 Cps, Db.	Range of SISI Scores at 1,000 Cps, %	Range of SISI Scores at 4,000 Cps %
Conductive	21	5–60	15–60	0–15	0–15
Noise-induced (acoustic trauma)	9	(–10)–0	30–70	0–40	95–100
Ménière's	8	50–70	45–80	70–100	95–100
Presbycusis	34	0–65	30–75	0–100	0–100
Retrocochlear	3	(–5)–85	45–70	0	0%

tested at 1,000 cps, this patient, *a woman of 80*, was able to hear, unfailingly, a *1-db.* increment superimposed on a tone only 10 db. above her absolute threshold. The reader who has had some experience with signals of this nature will readily appreciate that 1-db. increments are not easily heard under any circumstances.

Such findings cannot be ignored. They imply that, for a reason or reasons presently unknown, certain types of hearing loss render the patient able to hear remarkably small changes in sound intensity, relative to the differential intensity sensitivity of normal listeners at equivalent sensation levels.

A number of generalizations are suggested by the above case reports. Table 1 summarizes SISI findings in 75 patients with various types of hearing loss. These 75 patients were selected from a larger pool on whom SISI scores were available, because they fitted clearly into reasonably well-defined clinical categories of loss. Patients were assigned to the pure conductive, noise-induced, Ménière, and presbycusis categories on the basis of medical diagnosis by members of the staff of the Department of Otolaryngology, Northwestern University Medical School. The three patients in the retrocochlear category were so assigned on the basis of surgical findings by members of the Staff of the Department of Neurology and Psychiatry, Northwestern University Medical School and of the Chicago Wesley Memorial Hospital. Two were cases of surgically confirmed acoustic neurinoma, and the third was a case of a surgically confirmed, relatively large space-occupying lesion of the left temporal lobe.

Inspection of Table 1 suggests several tentative conclusions. First, conductive losses found the SISI task extremely difficult. None of the 21 conductives tested achieved a SISI score higher than 15% at any test frequency.

Noise-induced losses behaved quite differently. At 1,000 cps, where hearing was still within normal limits, no subject did better than 40%. At 4,000 cps, however, in the region of the loss, the *lowest* score obtained was 75%, and the modal value was very close to 100%.

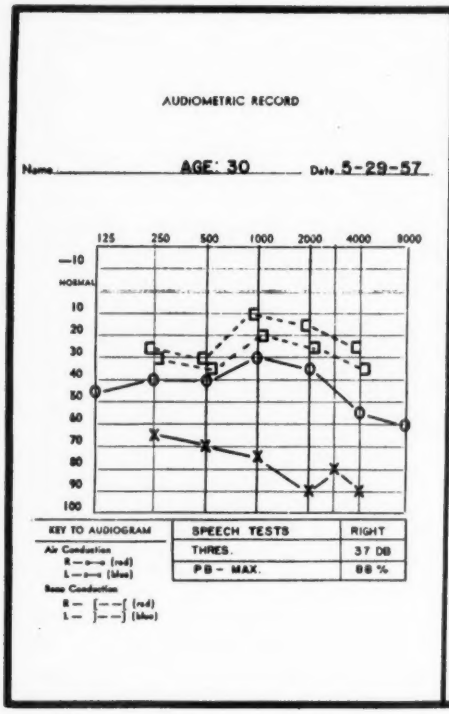
Patients with Ménière's disease demonstrated astonishing facility with the task. Again, the *lowest* score obtained by a patient in this group was 70%, and this was actually quite low for the group as a whole. The modal value was very close to 100%.

In presbycusis, any level of performance may be expected. In general, there is a tendency for the SISI score to increase with frequency, but scores may range from 0 to 100% at both 1,000 and 4,000 cps. Some patients heard none of the increments at either 1,000 or 4,000 cps; others quite effortlessly responded to all of them at either frequency.

Those with retrocochlear losses did even less well than conductives. None of the three patients in this group responded to any increment at any frequency.

Reliability

Figure 8 summarizes SISI scores obtained on a single patient on eight different occasions over a period of 10 months. The loss is primarily conductive due to a chronic otitis media, accompanied by some second-



SUMMARY OF SISI SCORES ON ONE PATIENT WITH A MIXED-TYPE HEARING LOSS

TEST DATE	TESTER	SISI SCORE	
		1000 CPS	4000 CPS
2-6-57	ERH	5%	80%
2-13-57	ERH	0%	65%
2-20-57	ERH	0%	85%
3-6-57	JFJ	0%	95%
4-17-57	ERH	0%	80%
4-24-57	ERH	0%	75%
7-10-57	ERH	0%	95%
12-4-57	JFL	0%	80%

TEST EAR: RIGHT

DIAGNOSIS: OTITIS MEDIA WITH SECONDARY NERVE DEGENERATION.

Fig. 8.—Audiogram and repeated SISI scores on a patient with chronic otitis media accompanied by secondary sensorineural involvement.

ary sensorineural loss at high frequencies. SISI scores were obtained at two frequencies, 1,000 and 4,000 cps on the right ear, by three different testers. At 1,000 cps, where the loss was purely conductive, scores ranged from 0% to 5% on eight separate tests. At 4,000 cps, where some secondary cochlear involvement was apparently present, the eight separate scores ranged from 65% to 95%. These findings typify the test-retest stability characterizing the SISI procedure.

Another aspect of test reliability is the extent to which performance on the first half of the test agrees with performance on the second half. In order to evaluate this "split-half" reliability of the total test sequence, product-moment correlation coefficients were computed between the number of responses to the first 10 increments and the number of responses to the second 10 increments of the total 20-increment sequence. This analysis was based on a total of 129 available SISI-grams. Table 2 shows the correlation coefficients thus obtained at each of three frequencies, 250, 1,000, and 4,000 cps, corrected according to the Spearman-Brown prophecy formula.

While the correlation is relatively weak (0.72) at 250 cps, it appears to be reasonably satisfactory at 1,000 cps (0.95) and at 4,000 cps (0.96). The correlations suggest that the total 20-item test sequence has relatively good internal consistency.

TABLE 2.—*Split-Half Reliability Correlation Coefficients for SISI Scores at Three Frequencies*

	Frequency in Cps		
	250	1,000	4,000
No.	46	125	129
R	0.72	0.95	0.96

Comment

In view of Dix, Hallpike, and Hood's [25,26] recommendation that continuous stimulation should be avoided in testing patients with inner-ear lesions, many investigators may question the feasibility of sustaining a tone over the two-minute period required to present 20 increments. It should be emphasized, therefore, that we have found this to be no problem whatever. There is no evidence, in the present data, that discrimination becomes progressively worse over time. Indeed, when patients failed to achieve 100% scores, analysis invariably revealed approximately equivalent performance in the two halves of the test series. We are inclined to believe that the success of the method is, in fact, closely related to the use of sustained stimulation, and suggest this as a fruitful avenue for further research.

Finally, it should be emphasized that the purpose of this paper is not to propose final answers to the problem of an adequate methodology for the clinical assessment of differential intensity sensitivity. Our sole intent is to report findings with a particular technique that we have found to be simple, easily administered, and otherwise clinically feasible, and which seems to distinguish reasonably well certain types of hearing loss.

Summary

A unique method for the clinical assessment of differential intensity discrimination is described. Short (200 msec.) 1-db. intensity increments are superimposed, at five-second intervals, on a pure tone of constant amplitude at a sensation level of 20 db. The patient responds to the momentary changes in loudness. The procedure is called SISI (short increment sensitivity index), and results are expressed in terms of the percentage of 20 increments to which a response is made.

Findings on selected individual cases are reported in order to illustrate the manner in which the SISI score varies with different kinds of hearing loss.

Results obtained in 75 patients with various types of hearing loss are reviewed. Conductive and retrocochlear losses showed very low SISI scores, never exceeding 15%. Ménière and noise-induced losses, on the other hand, yielded relatively high percentages, the lowest score obtained in any of these patients being 70%.

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Objective Speech Audiometry in Cases of Nonorganic Hearing Loss

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The incidence of nonorganic hearing loss has increased considerably in the past several decades with greater opportunities to claim compensation for physical disability and injury. For this and other reasons, increasing attention has been given to the development of new and improved techniques for distinguishing nonorganic from organic hearing impairments.[1,2]

Methodologies for detecting nonorganic deafness were first introduced when there were few malingerers and no electron tubes. Now that both are abundant, the same tests are still widely and effectively used, though they are no longer considered sufficiently definitive for diagnostic purposes. It is evident that techniques are needed which not only differentiate nonorganic from organic losses, but which contribute to the establishment of organic threshold as well. To this end, the purpose of the present report is to describe the performance on objective speech audiometry of persons exhibiting nonorganic hearing loss.

With one notable exception, all of the tests developed up to the present time share a fundamental weakness in that they are based on the subject's voluntary responses while trying to show that these responses are not reliable. The success of these tests generally depends on disturbing the subjective "loudness yardstick," i. e., using any of various devices to make a sound seem louder or less loud than it ordinarily would. Since the loudness of a sound constitutes the subject's only means of judging when it is sufficiently intense to respond to, then any means of changing the apparent loudness without changing the intensity will result in marked inconsistency of responses. However, although it can often be established in this way that the apparent threshold is not the true organic threshold, the level of organic acuity still has not been determined. The same kind of reasoning applies to tests whose aim is to confuse the subject as to the sensory channel through which a message was received, e. g., the "shifting speech" test which presents parts of the message to the "bad" ear in unilateral cases, and parts of it to the "good" ear in such a way that the subject has difficulty remembering what was heard in each ear and may respond to parts of the message heard in the supposedly bad ear.

A few of the tests for nonorganic hearing loss in use today contain an element of quantification. For example, the Stenger test often yields a number that constitutes an estimate of the difference between the two ears. Presumably, if the "better" ear is admittedly normal, we are in a position to say that the loss in the "poorer" ear does not exceed a certain value. It is important to note, however, that such estimates are rough and likely to be biased on the conservative side, since the difference between the two ears might well be less than the estimate. Similarly, the Lombard and the delayed side-tone tests yield rough conservative estimates of organic threshold, at best.

In general, it is safe to say that no test yet devised that is based on voluntary responses can yield reliable estimates of hearing acuity in nonorganic cases, except insofar as it may motivate a malingerer to abandon his pretense and give correct voluntary responses on subsequent tests.

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A method of measuring hearing acuity that does not depend on the subject's voluntary responses was introduced in 1948 by Bordley, Hardy, and Richter,[3] who used conditioned electrodermal response (EDR) as an objective criterion for audibility of pure tones. In employing this technique, the subject is conditioned to expect an electric shock whenever he hears a tone. The expectation of this shock causes an involuntary drop in the electrical skin resistance, which can be measured by means of electrodes taped to the skin. Thus, the presentation of a tone at or above its threshold elicits an observable involuntary response; presentation of the same tone below threshold elicits no response. In this way, a complete audiogram can be plotted.

EDR has proved extremely useful, not only in cases of nonorganic hearing loss but also in testing the hearing of children too young to give reliable responses. Since its introduction, the methodology has been considerably refined, particularly through the use of improved instrumentation. Stewart [4] has developed an EDR instrument which, when used with certain defined criteria, allows the clinician increased stability of judgment of the electrodermal response. Doerfler and McClure,[5] using Stewart's criteria and apparatus, found that pure-tone thresholds obtained by EDR audiometry fell within 5 db. of those measured by conventional audiometry. Thus, it is possible to obtain pure-tone thresholds objectively with a high degree of validity, at least in certain cases of organic hearing impairment.

Although EDR audiometry has been of continuing value as a truly objective technique for determining pure-tone threshold, it is, nevertheless, incomplete diagnostically because it does not fill the need for information regarding hearing for speech. The value of speech reception thresholds and tests of auditory discrimination as a supplement to the audiogram need not be reemphasized here.

Some attempts have been made to apply the EDR principle systematically to speech audiometry. Notable among these was an investigation by Knapp and Gold,[6] who recorded changes in skin resistance following stimulation with various intensity levels of speech. A comparison was made among the performances of subjects having nonorganic hearing loss and those possessing organic loss and normal hearing. Three values were recorded: the level at which speech stimulation first elicited a change in skin resistance, the level at which awareness of speech was first reported by the subject, and the lowest level at which the subject reported understanding speech.

Although the results of this experiment were of considerable interest, the technique did not gain clinical acceptance for several reasons: first, because no conditioning was used, so that responses were weak and subject to rapid extinction; second, because the patient was called upon to give verbal responses which could easily give rise to resistance drops that might be confused with electrodermal responses to the primary stimulus; third, and most important, because only the threshold of *detectability* was measured objectively, not the threshold of *intelligibility*. The determination of the latter was still dependent on voluntary responses.

This distinction is fundamental to the unique diagnostic value of speech audiometry. The threshold of detectability tells us little that can not as easily be obtained from the pure-tone audiogram. On the other hand, the speech reception threshold (SRT) is a measure of intelligibility, not merely sensation. That is, understanding is a necessary component of the speech-reception threshold.

Since any technique that purports to be an objective measure of hearing for speech must reveal whether speech stimuli are understood or merely detected, simple conditioning such as is used in conventional electrodermal audiometry will not suffice. This type of conditioning causes a relationship to exist between the conditioned and unconditioned stimuli such that responses will be obtained to all speech items heard, whether or not they are understood. Instead, some form of conditioning must be em-

ployed that will result in distinctly different responses when speech is understood from those when it is not.

Such a technique was developed and validated by Ruhm and Carhart.[7] It was found that the speech-reception threshold, as obtained in the conventional manner on normal and conductively impaired persons, could be predicted within 2 db. by means of the new technique. Briefly, the method is based on differential conditioning to a key word selected from a list of conventional spondaic words. More specifically, the subject is trained to expect an electric shock after each presentation of the key word, but not following any other word during a presentation of the entire spondee list. The key word is presented randomly approximately 25% of the time in each full list presentation. The result is a *distinctive* EDR response pattern. As long as the words are intelligible, recorded electrodermal responses to the key word are consistently much larger than those following the neutral words. On the other hand, when the words are audible but not intelligible, responses to all words are of intermediate magnitude and are indistinguishable from one another. Of course, a further reduction in intensity to a level below the threshold of detectability yields no responses. In this way, it is possible to measure with great accuracy both the threshold of detectability and the threshold of intelligibility during the same testing session in persons with normal hearing or organic loss.

Because of the possible diagnostic value of the new technique, the present study was undertaken to appraise the usefulness of this type of electrodermal speech audiometry in assessing speech reception thresholds in cases of nonorganic hearing loss.

Subjects

The experimental sample consisted of 30 Armed Forces veterans whose hearing impairments were suspected of being partly or wholly nonorganic in nature. All of the subjects were being examined at the Veterans Administration Hospital Audiology Clinic in Chicago. Twenty-nine were male and one female, ranging in ages from 25 to 53 years.

Any one or more of the following criteria were used for judging the presence of a nonorganic component:

1. Discrepancies in excess of 10 db. between the voluntarily obtained SRT and the average loss for pure tones in the speech range (500-2000 cps)
2. Discrepancies in excess of 10 db. at any frequency between the conventionally obtained audiogram and pure-tone EDR thresholds
3. Positive results on any two or more standard tests for nonorganic involvement, such as the Doerfler-Stewart, Stenger, modified Stenger (speech), shifting speech, Lombard, and delayed speech feed-back

Procedure

All speech testing was done in a suite of two good-quality, sound-treated rooms equipped with a custom-built speech audiometer suitable for monitored live-voice testing. Also installed in the control room was a psychogalvanometer (Grason-Stadler, Model E664). The room in which the subject was seated contained a set of PDR-8 earphones and the two pairs of zinc electrodes connected to the psychogalvanometer, as well as a grounded steel plate used to isolate the resistance electrodes from the shock electrodes.

The electrodermal speech reception threshold (ESRT) was obtained in the manner described by Ruhm and Carhart.[7] After the electrodes had been affixed in the usual way for pure-tone electrodermal audiometry, the subject was instructed to sit quietly and *not* to repeat the words he would hear. He was then conditioned to expect a shock following the key word "baseball" but not at any other time. It should be reemphasized that this type of conditioning departs from the variety used in pure-tone electrodermal audiometry in that it requires a distinctive differential response, rather than the same magnitude of response to all stimuli. The criteria for judging the distinctiveness of recorded responses were (1) that the amplitude of the stylus deflection following the key word be at least 10 mm. greater than that following any neutral word at the same presentation level, and (2) that the rate of stylus deflection be at least 2 mm. per second. Once differential conditioning had been established, the speech audiometer was set for maximum attentuation to begin an ascending search for the speech reception threshold. The level was gradually increased without a break in the continuity of word presentation, until differential responses were obtained again. The level was then reduced in 2 db. steps until differential responses disappeared, at which time another ascending sequence was begun. A minimum of two ascending and two descending thresholds were obtained in

Test Results for Cases of Nonorganic Hearing Loss

Subject	Speech Reception Threshold			Voluntary Pure-Tone Threshold		
	Voluntary 1	Electrodermal	Voluntary 2	500 Cps	1,000 Cps	2,000 Cps
1	30	0	46	75	50	75
2	60/46 *	−2	60/48 *	70	85	75
3	42	4	8	30	35	55
4	20	−2	6	30	30	25
5	60	44	46	75	75	70
6	30	14	14	30	15	15
7	NR	50	NR	NR	NR	NR
8	58	28	40	50	60	65
9	76	62	66	65	85	90
10	66	4	4	55	55	65
11	50	38	42	40	40	50
12	28	12	14	40	55	90
13	90	40	40	70	95	105
14	40	8	14	45	40	70
15	60	CNC	34	70	70	85
16	46	10	26	35	50	65
17	46	2	10	5	5	75
18	28	12	12	30	35	50
19	NR	14	30	NR	NR	NR
20	100+	8	12	50	70	90
21	28	2	8	20	50	70
22	NR	70	NR	NR	NR	NR
23	32	4	48	100	80	85
24	50	38	38	70	80	80
25	74	58	60	70	65	75
26	62	6	18	45	55	65
27	98	4	4	NR	NR	NR
28	34	22	26	15	35	60
29	NR	12	NR	NR	NR	NR
30	60	CNC	26	70	70	70

NR, no response.
CNC, could not condition.
* Opposite ear masked.

this way. The value recorded as the electrodermal speech reception threshold (ESRT) was the lowest level at which clear differential responses were obtained 50% of the time. Immediately following the ESRT, a voluntary SRT, (VSRT 2) was obtained by conventional technique.

Since, in the preliminary test routine, a voluntary SRT (VSRT 1) had been measured, it was then possible to compare the voluntary thresholds preceding and following electrodermal speech audiometry with the objectively measured SRT, as well as with each other.

Results and Comment

The test results for the experimental group are shown in the Table. Performance on electrodermal speech audiometry as compared with voluntary responses revealed the following information:

1. Extrapolating for the four subjects who on the first test denied hearing any sound at the upper limits of the speech audiometer, the mean difference between initial voluntary speech thresholds and objectively measured speech thresholds exceeded 45 db. Except in two cases where differential conditioning could not be established, the ESRT was 12 to 94 db. better than previous voluntary thresholds.

2. In 24 out of the 28 cases who were differentially conditioned, the validity of electrodermal speech audiometry was substantiated within clinical error (4 db.) as judged by the agreement between objectively obtained thresholds and those measured by either the second voluntary SRT or the pure-tone EDR average (500-2,000 cps).

These results suggest that in a population of cases exhibiting nonorganic hearing loss, measurement with electrodermal speech audiometry yields speech reception thresholds which are markedly lower than those obtained by an initial voluntary test. That the organic threshold is reached in these

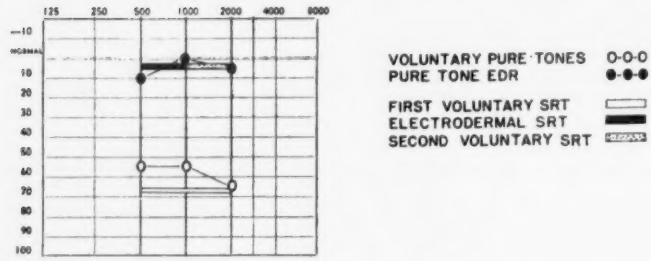

Fig. 1.—Subject 10.

cases by means of the new technique is, of course, open to question. The validating criteria obtained by Ruhm and Carhart [7] showed that the method is capable of yielding speech reception thresholds within a 2 db. margin of error in persons with organic hearing loss. Insofar as these results can be applied to cases exhibiting nonorganic loss, it might be reasonable to assume that here, too, the organic threshold is established. Further research is necessary, however, to determine whether such reasoning is tenable.

The addition of the new technique to the test battery already at hand provides the clinician with two major advantages. First, a comparison with pure-tone electrodermal results is possible, permitting relationships to be drawn similar to those for voluntary thresholds based on analagous stimuli. Secondly, the fact that speech is employed as the stimulus permits an objective evaluation of the patient's functioning on a more "practical" level than can be achieved by means of pure-tone electrodermal audiometry.

Because of the uniqueness of individual cases where nonorganic hearing loss is involved, it is meaningful to describe certain illustrative examples.

Figure 1 shows the pure-tone and speech thresholds obtained by both voluntary and electrodermal techniques for one subject. This 42-year-old man gave initial responses that indicated a loss of 66 db. for speech and 58 db. for pure tones (500-2,000 cps average). The Doerfler-Stewart test strongly suggested a nonorganic component. The pure-tone electrodermal test showed an average (500-2,000 cps) loss of 5 db., while the ESRT was found to be 4 db. The subsequent voluntary SRT of 4 db. exactly matched the electrodermal threshold, further proof of normal hearing being furnished by the final audiogram.

This case is typical of about one-fourth of the total number of subjects in that both the electrodermal speech reception threshold and the subsequent voluntary threshold showed essentially normal hearing.

Figure 2 illustrates somewhat similar findings in the case of a 28-year-old veteran, with two noteworthy differences: The initial tests suggested a nearly total unilateral loss, and, as was later found, there was a true high-frequency drop above 1,000 cycles. The subject admitted to hearing speech at 100 db. above normal threshold but denied being

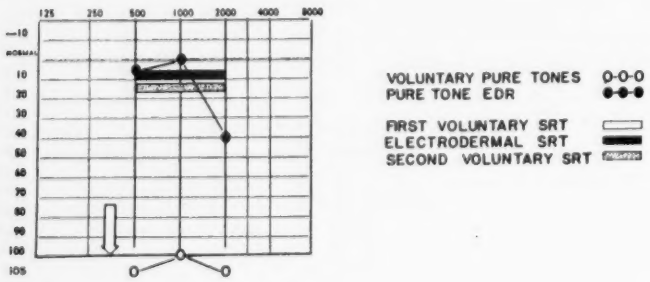

Fig. 2.—Subject 20.

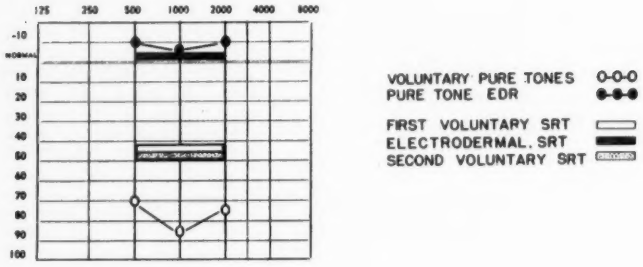

Fig. 3.—Subject 2.

able to understand the words. Voluntary pure-tone thresholds were obtained at 100 db. for 1,000 cycles and at 105 db. for 500 and 2,000 cycles, the opposite ear being masked in each case. Interestingly enough, the corresponding unmasked thresholds were found at approximately the levels where "shadow" responses would normally have been expected. However, pure-tone and speech Stenger tests as well as the shifting speech test clearly indicated a nonorganic component. The ESRT of 8 db. on the "poorer" ear was readily substantiated by a second voluntary SRT of 12 db. It is interesting to note that the electrodermal audiogram showed normal hearing at 500 and 1,000 cycles, the sharp drop at 2,000 cycles being absent in the voluntary curve, probably owing to the presence of recruitment.

A different type of case is illustrated in Figure 3. A previous psychiatric diagnosis of anxiety hysteria with predisposition to deafness had been made by staff psychiatrists at the Veterans Administration West Side Hospital. The initial audiogram showed a unilateral hearing loss averaging 77 db. The speech tests were somewhat bizarre in that the SRT obtained on the poor ear with the opposite ear masked was consistently better than when no masking was used. The electrodermal SRT of −2 db. was preceded and followed by voluntary thresholds of 60 db., with corresponding masked thresholds of 46 and 48 db., respectively. The close agreement between the two sets of voluntary speech tests is unusual and may be symptomatic of the psychogenic nature of the loss, although the number of diagnosed psychogenics in the present group is by no means sufficient to draw valid inferences.

A case of organic hearing loss with nonorganic overlay is illustrated in Figure 4. The voluntary thresholds of 60 db. for speech and 73 db. for pure tones were discrepant, as were the responses to the Doerfler-Stewart test. The ESRT of 44 db. was later corroborated by a voluntary 46 db. Pure-tone EDR thresholds could not be obtained in this case.

Figure 5 shows another instance of nonorganic overlay superimposed on a true hearing loss. This 38-year-old man denied hearing any sound whatever in the left ear, while exhibiting a 74 db. loss for speech in the right ear. However, electrodermal speech audiometry clearly showed a loss of

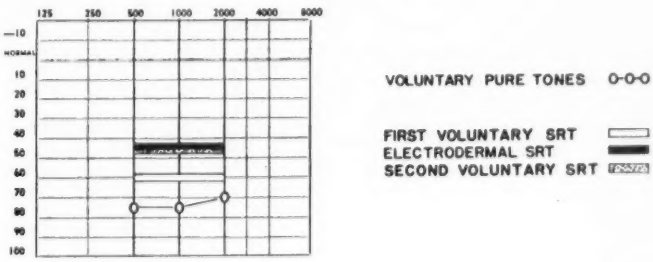

Fig. 4.—Subject 5.

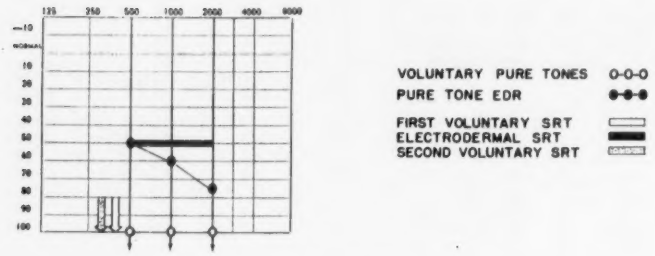

Fig. 5.—Subject 7.

50 db. for speech on the left ear. Interestingly enough, the final attempt to obtain a true SRT voluntarily again resulted in no response in the left ear, although lowered responses were obtained from the opposite ear where the total audiometric picture was otherwise similar.

The described cases are not intended as an exhaustive delineation of the results which may be obtained by electrodermal speech audiometry. Their importance derives from the fact that differences between individual subjects' performance appeared both preceeding and following objective speech threshold measurement. After further study, such difference may serve a diagnostic function in evaluating the etiology of nonorganic hearing loss.

A final point should be given attention. The relationship between the ESRT and the second voluntary SRT is of particular interest in connection with this study, because of the unexpectedly high proportion of subjects whose nonorganic components greatly diminished or even disappeared after the ESRT.

1. Of the 28 cases where differential conditioning was established, 15 gave subsequent voluntary responses within 4 db. of the ESRT, and 20 within 8 db.

2. Out of 30 subjects 27 showed improvement in voluntary speech thresholds after ESRT, ranging from 8 db. to 94 db., *including the two subjects who could not be differentially conditioned.* Of the three who did not show improvement, one had been diagnosed as psychogenic, and another was under psychiatric observation.

3. Of the 10 subjects who at no time exhibited voluntary speech responses within 8 db. of the ESRT, 7 nevertheless showed improvement of 18 to 70 db. between the two voluntary speech tests.

It seems, then, that strong motivation is provided by the ESRT test for abandonment of nonorganic components.

Summary

The present study was undertaken to evaluate the performance on electrodermal speech audiometry of a group of subjects exhibiting nonorganic hearing loss.

The test was administered to 30 subjects with nonorganic involvement determined on the basis of otological diagnosis and a complete audiological test battery. A final voluntary speech reception threshold was obtained following electrodermal speech audiometry. The results indicate the following:

1. Subjects exhibited substantially better thresholds as measured by electrodermal speech audiometry than by conventional speech audiometry. It is proposed that the objectively measured threshold is a close approximation of the organic speech reception threshold.

2. Voluntary thresholds obtained after electrodermal speech audiometry were, with few exceptions, better than those measured before. This finding indicates an abandonment, at least to some degree, of the nonorganic component following administration of the new technique.

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Case Reports

Cavernous Sinus Thrombosis

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Cavernous sinus thrombosis was described from the anatomopathological point of view for the first time by Duncan in 1821, and from the clinical point of view by Bright in 1831.

From that time up to the antibiotic era the treatments tried had not modified the prognosis of this severe malady.

The discovery of antibiotics has changed the prognosis to such an extent that the surgical methods recommended by some older authors cannot be taken into consideration any longer.

The process of the thrombosis starts from the neighborhood; rarely does it start hematogeneously from more remote regions, i. e., puerperal fever. It is rarely a consequence of an intracranial venous thrombosis; most frequently of an infection in the region of the face.

According to Shaw,[6] the starting point in 61% of cases is facial furuncle; in 5% of cases facial erysipelas, in 15% sinusitis, in 8% otitis, in 7% teeth affections, in 2% other mouth affections without the teeth being involved; in 2% of cases there is no determined starting point.

Christophe points out the possibility of acquiring this affection during the evolution of a septic angina, or after a tonsillectomy.

The most frequent route of propagation is through the angular vein, which links the venous system of the upper half of the face with the cavernous sinus; somewhat rare, although possible, are the routes through the pterygoid plexus or through the olfactory perineural sheath. In the case of otitis or otomastoiditis the route of propagation is through the petrous sinus of the pericarotid venous plexus; the petrous apex may as well be the origin of cavernous sinus thrombosis.

The affection presents two clinical forms: the acute form, more frequent and consequently better known, and the chronic one, somewhat rarer, although described by some authors (Barraquer-Bordas [1] and coworkers have recently described a case with a seven months' evolution). The most frequently met micro-organisms are the streptococci and staphylococci, which cause a swelling of the intima, which becomes edematous, causing a narrowing of the sinus lumen, with the slowing of the blood stream that is favorable to the formation of the thrombus.

The thrombus may extend toward the orbit through the ophthalmic veins or on the opposite side through the circular vein.

The clinical aspect is impressive. The patient has fever, chills, sepsis, persistent pains in the orbit. He presents signs of meningeal irritation (headache, nausea, vomiting, stiffness of the neck, Kernig's and Brudzinski's signs).

The eye examination is characteristic: exophthalmos, unilateral in the beginning, bilateral later on, accompanied by chemosis, palpebral edema, and fixity of the eyeball. The involvement of the cranial nerves which pass through the cavernous sinus or in its neighborhood may cause pain in the region of the trigeminus, palpebral ptosis, strabismus, and alteration of the pupil. Lastly, involvement of the ocular nerve causes blinding of the patient. The classical ocular signs may be absent or may be in-

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complete when in the chronic forms a collateral circulation has been established.

On examination of the eyegrounds the retinal veins are found dilated: the status of the papilla is not constant.

The white cell count shows a high leukocytosis with polynucleosis. The blood culture is positive if taken before the administration of the treatment.

Sinus thrombosis may be associated with other intracranial complications: meningitis, cerebral suppuration (diffuse encephalitis or cerebral abscess).

Differential diagnosis is to be made with reference to orbital cellulitis, which is only unilateral, while thrombosis may be bilateral. In thrombosis the general signs of sepsis are on the first plane, with a severe deterioration of the general condition; the eye is not so stiff and immovable in orbital cellulitis.

The prognosis is grave. Death is caused by meningitis, by embolism, or comes with manifestations of sepsis. As we mentioned in the beginning, the antibiotics have completely changed the prognosis. During the last few years an ever-growing number of healed sinus thrombosis cases have been reported.

In the preantibiotic era, attempts were made to approach the cavernous sinus by surgical means, by the orbital and temporal route, with or without the link of the internal carotid artery. Today these methods are discarded, the medical treatment being preferred.

The main condition for the effectiveness of the treatment is promptness. The sooner we apply our treatment the more favorable the prognosis will be.

Antibiotics are administered after tests which show to which antibiotic the bacterial flora is more sensitive. The use of the antibiotics toward which micro-organism has not reacted in vitro is also indicated, because in vivo its reaction may be changed. The doses should be large, long-continued, and frequently administered. They vary according to different authors (Rattner and Tytus[5] give 25,000,000 units a day). We think that doses of about 800,000 penicillin units a day associated with 1 gm. streptomycin, 1 gm. chlortetracycline (Aureomycin), and 1 gm. chloramphenicol (Chloromycetin) are sufficient. The anticoagulants are essential in the treatment of sinus thrombosis. Heparin 100-300 mg. daily should be administered intravenously. Laporte suggests a systematic combination of anticoagulants with antibiotics in the treatment of facial furuncle in order to prevent sepsis.

Of great help is a method forgotten of late: the fixation abscess, which often contributes to the solving of some cases of sepsis which antibiotics alone cannot solve.

The general condition will be helped with vitamin therapy, especially with vitamin C and with small, repeated blood transfusions. The above-mentioned treatment is discontinued only when the clinical signs and the laboratory data show that the process of sepsis has been stopped.

Report of Case

The patient, 37 years of age, a tailor, was admitted to our section on Oct. 16, 1956, with fever, headache, and swelling of nose and lids.

There was nothing of importance in his direct or collateral hereditary antecedents. He had had hepatitis and hyperthyroidism. He had facial folliculitis; 35 days before admission he had undergone a nasal polypectomy in the V. Roaita Hospital, and 28 days before had been reoperated on. Twenty days before coming to us he had left the V. Roaita Hospital, in satisfactory general condition. The present malady began a week before coming to us with an aching nasal tumefaction which the second day extended to the lids, with fever, chills and deterioration of his general condition. Penicillin, streptomycin, chlortetracycline treatment did not change the evolution of the disease, and the patient was seen by one of us (V. T.) the night before being admitted to our hospital. He found facial erysipelas, cavernous sinus thrombosis, and meningitis. Accordingly the patient was admitted to our section.

General Examination.—Height: 1.62 meters (5 ft. 4 in.); weight: 58 kg. (128 lb.). Pallid mucosa. Musculoadipose system little developed. Osteoarticular system intact. Lymph nodes not palpable. Nothing remarkable in the digestive, respiratory, and urogenital system.

Circulatory Apparatus.—A. T. 12-7, pulse 120, normal beats. Cardiac area: cardiac rhythm normal.

Nervous System.—The patient was in a state of obnubilation: "hardly recognized the persons around him"; hardly answered questions. He had a stiff neck with positive Kernig and Brudzinski signs. No patellar or Achilles reflexes. Indifferent plantar reflexes.

E. N. T. Examination.—Buccopharynx: muca of normal aspect; tonsils with no sign of inflammation. Nose: red; aching, swelling of the nasal pyramid which involves the bilateral inferior and superior lids. The right nasal fossa was occupied by a swelling with mucopurulent secretions.

Ear Examination.—Eardrums of normal aspect.

Ophthalmologic Examination.—Intense palpebral edema of the swelling type with conjunctival chemosis, more intense at the right eye. At the right eye greater exophthalmos. Necrotic bulbar conjunctiva.

Obvious reduction of movements of the right eyeball, less of the left one. The edematous process seemed to extend retrobulbarily at the left eye. The visual acuity at the right eye seemed to be nil. The patient stated that he did not perceive light with the right eye.

Examination of the Fundus of the Eye.—Tortuous and moderately dilated veins. Slight papillar edema in section. Arterial (20) and venous hypotension, greater in the right eye than in the left one. Spontaneous arterial pulse, intermittent.

Blood Culture.—Colonies of Proteus vulgaris and enterococci.

Hemogram.—H, 4,000,000; L, 26,800; N, 80%; E, 0; B, 0; L, 14; M, 6.

Lumbar Puncture.—Normotensive, xanthochromic, cloudy fluid. The Queckenstedt sign was negative. Pandy reaction ++; Nonne-Appelt reaction +++.

Rare isolated red cells; 134.5 cellular elements per cubic millimeter (polymorphonuclear cells 74%, lymphocytes 18%, and endothelial cells 8%). The cultures remained sterile 72 hours at 37 C.

Treatment was administered as follows: 800,000 penicillin units a day, chlortetracyline or oxytetracyline 1 gm. a day, heparin 300 mg. a day, and local compresses with boric acid, eye instillation of bismuth tribromphenate (Xeroform) 5%, blood transfusion 200 cc. every fourth day, vitamin C 500 mg. every day, vitamin B 25 mg. every day.

After 72 hours the palpebral edema began to subside. Fever oscillated to settle in the fourth day at 38 C (100.4 F). After 72 hours the patient was more conscious. Blindness persisted in the right eye. The exophthalmos was improved after five days, the palpebral edema was much reduced. On Oct. 20: L, 16,700; N, 34%; L, 14%; M, 2%.

On Oct. 23: 10,400 leukocytes. The palpebral edema and the chemosis continued to subside. On Oct. 26 the stiffness of the neck had completely disappeared. Lumbar puncture: clear fluid; negative Pandy and Nonne-Appelt reactions; 10 cellular elements per cubic millimeter.

Beginning Oct. 26, 1 gm. of clorocid a day was added.

On Oct. 27: 13,000 leukocytes, with 78% neutrophils, 20% lymphocytes, 2% monocytes.

The patient did not perceive light with the right eye; with the left eye he was able to recognize a coin of 1 cm. diameter at 3 meters' distance (the length of the room). The fundus of the eye was normal in the left eye. In the right eye the venous stasis, the slight papillar stasis, and arterial and venous hypotension were maintained.

On Oct. 30, since the temperature remained at 38 C (100.4 F), and in spite of the almost complete disappearance of the stasis phenomena in the venous circulation, a fixation abscess was instituted with a subcutaneous injection in the left hip of 2 cc. sterile oil of turpentine.

Ocular Examination.—The slight papillar edema and the venous stasis persisted. The tension of the central artery of the retina increased by 30 gm. The venous hypotension was maintained.

On Nov. 1, there were 19,700 white blood cells. On Nov. 5, we opened the fixation abscess, finding there almost 200 cc. of yellow pus.

After Nov. 6, the fever went down to almost 37 C (98.6 F) in the evening and after Nov. 9, the patient had no more fever.

The chemosis and the palpebral edema had completely disappeared. The eyeground was normal on Nov. 8, with blindness in the right eye and almost normal sight in the left eye; after Nov. 10, penicillin was discontinued; streptomycin and oxytetracycline after Nov. 16, and the clorocid after Nov. 21.

The general condition of the patient was good. He got up with no help. After Nov. 13, he complained of right frontal cephalea. The radiography of the facial sinuses showed a mucosal hyperplasia of the right maxillary sinus. Maxillary exploration puncture was negative. On Nov. 23, the patient had a swelling of the right frontal region, above the right eyebrow. Radiography of the frontal bone showed a circumscribed lysis of the frontal bone with a diameter of 3 cm. The patient was transferred to the neurosurgical clinic with the diagnosis of osteomyelitis of the frontal bone. There the focus of osteomyelitis was opened, and sterile pus was found.

At present the patient is healed.

The amount of antibiotics given was as follows: penicillin: 19,600,000 units; streptomycin 31 gm.; oxytetracycline or chlortetracycline 20 gm.; clorocid 26 gm. Heparin administered amounted to 4,500 mg.

As to the etiology in our case, the inception of the disease is too far from the last surgical operation to see any connection between them. The erysipelas which was the starting point of the infection may have been caused either by the patient's having injured the region of the operation or by the folliculitis on this face.

Another interesting aspect of the case is the flora found in the blood culture, the flora consisting for the most part of saprophytes. This pathogenicity of the saprophyte organisms, which follows the disappearance of the usual pathogenic forms after the treatment with antibiotics and favors the evolution of other micro-organisms, has been described by Womack as superinfection.

We cannot conclude without emphasizing once more the role of the fixation abscess, which was successfully used at a time when the resolution was not certain in spite of the massive administration of antibiotics. That is why we recommend again—as one of us has formerly done—this excellent therapeutic method, which gave good results in cases of sepsis and even meningitis in the preantibiotic era and which completes the modern therapy.

Str. Occident 11.

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Leiomyoma Laryngis

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The leiomyoma is a tumor rarely encountered in the larynx. Only four cases have been found in the available literature.

The first case was reported by Z. Dongány [1] in 1912. This was a 10-year-old boy with a smooth-surfaced tumor on the edge of the left ventricular band close to the anterior commissure. The tumor was the size of a hazelnut and was removed by way of direct laryngoscopy after a preliminary tracheotomy.

In 1913 M. Weil [2] reported another case. This was a 67-year-old man, with a pedunculated tumor of the size of a bean, in the region of the posterior end of the left ventricle. Removal of this tumor was accomplished with a snare, but a hemorrhage followed which lasted one hour.

A third case, reported by Haslinger, is mentioned in the book of Eggston and Wolff.[3] This was also a pedunculated tumor originating from the aryepiglottic fold.

Jackson [4] reported a tumor in a 48-year-old man which was first diagnosed as a leiomyoma but which later developed sarcomatous changes. This tumor did not have a laryngeal origin but came from the esophagus; it was not accepted by Neivert and Royer as a real laryngeal leiomyoma.

In the American literature Neivert and Royer [5] reported the first real leiomyoma in 1946. It was found in a 75-year-old man who had a large round, smooth-surfaced tumor in the vestibule, originating from the right aryepiglottic fold and filling out and completely obscuring the larynx. Because of the vascular appearance of the tumor the authors hesitated to take a biopsy specimen. Total removal was done, under intravenous thiopental (Pentothal) sodium anesthesia, through an infrahyoid incision. The operation was preceded by a tracheotomy. One of us (S. K.) also saw this case during residency in Presbyterian Hospital in New York.

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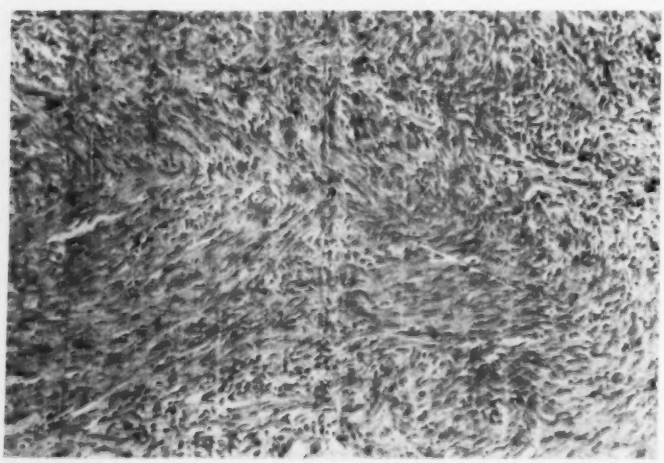

Fig. 1.—Connective tissue fibers (in center). The inflammatory reaction (upper left).

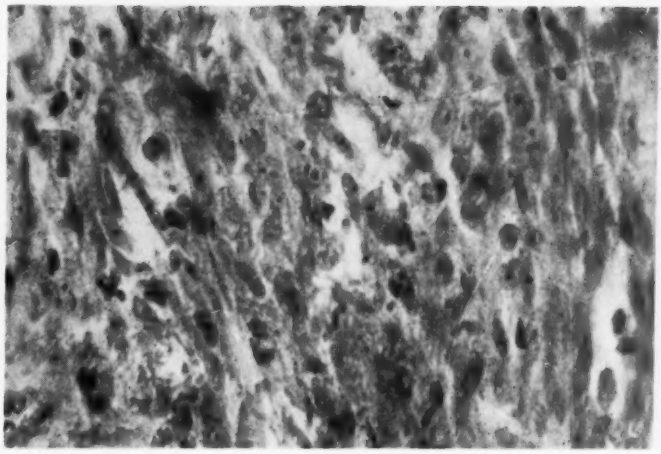

Fig. 2.—Smooth muscle bundles. Large vesiculated nuclei with nucleoli.

The histologic examination of the above-mentioned cases clearly showed that they were certainly benign smooth-muscle tumors. In the descriptions of the Neivert-Royer case the pathologist states that this was a vascular-type leiomyoma. Usually these lesions are believed to take their origin from the smooth muscle fibers of the blood vessels.

Because of its rareness and scientific interest we felt that it might be worth while to report an additional case.

Report of Case *

A 40-year-old housewife was examined by one of us (S. K.) in the office on June 30, 1954. She was complaining of some difficulty in swallowing.

Clinical examination revealed a pinkish, smooth-surface pedunculated tumor on the right aryepiglottic fold. It was about the size of a large cherry and was sagging toward the right pyriform sinus. Because of the benign appearance of the tumor, we preferred to remove it completely instead of doing a biopsy. The patient did not permit any kind of intervention, and left. One month later she came back and accepted surgical treatment.

The total removal of the tumor was accomplished on the examining chair under topical tetracaine (Pontocaine) 2% anesthesia with a snare through indirect laryngoscopy. The base of the pedicle on the right aryepiglottic fold measured approximately 8×3 mm. There was no hemorrhage, and the healing was completed in one week.

The patient has been observed many times during the last three and one-half years without any indication of a recurrence.

The histopathologic report, which was made by one of us (B. P.) was as follows:

Sections from the largest portion of the tumor showed it to be covered with stratified squamous epithelium. In the subepithelial area there were edematous connective tissue fibers and dilated thin-walled lymphatics. In the central parts paratypical connective tissue fibers with large vesiculated nuclei and large nucleoli were seen. The blood vessels were filled with erythrocytes.

There was some inflammatory reaction with lymphocytic and polymorphonuclear leukocytic infiltration here and there. With Van Gieson's stain muscular bundles were stained yellow; there were no vessels with muscular walls to demonstrate that the tumor originated from the vessel walls. There was no cellular pleomorphism and no mitotic figures in any place.

Diagnosis: Leiomyoma with chronic inflammatory changes.

Summary

A case of laryngeal leiomyoma in a 40-year-old woman is reported, the first in the Turkish and the fifth of the world literature.

Soganci sokak No. 7, Cihangir.

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Clinical Notes, New Instruments and Techniques

Twin Phonoscope

A Technical Improvement in Ear Auscultation

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Auscultation of the ear is a procedure integrated with tubal inflation which may be performed with or without the use of a tubal catheter.

History

Catheterization of the Eustachian tube was invented by a layman. His name was Edmé Gillis Guyot[1]; his occupation, postmaster at Versailles. He presented his invention to the Royal Academy of Science in Paris in 1724, after he noticed improvement of his ear trouble following application of the technique on himself. Guyot used the oral approach to the tubal ostium pharyngeum. Insertion of the catheter through a nostril was first performed by Archibald Cleland,[1] an English Army Surgeon in 1744. This method became standard practice.

Politzer,[2] in 1863, made an important contribution. On the basis of the independent studies of Joseph Toynbee[4] and his own he found that the tubal ostium is dilated during the act of swallowing. This action is brought about by the tensor veli palatini, called by von Troeltsch[3] the "abductor tubae auditivae." Politzer utilized these facts for practical purposes. He showed that inflation of the tube can be obtained by propelling air from an air bag placed in one of the nostrils during the act of swallowing. Politzer's procedure is called "Politzerizing." Lucae found the same effect to be obtained by pronouncing certain vowels. Gruber noticed syllables such as "hik" or "huk" to be particularly helpful in this concern. Air inflation turned out to be an important adjuvant in diagnosis and treatment of middle-ear conditions.

Ear Auscultation

A valuable augmentation of this technique was contributed by Joseph Toynbee's invention of ear auscultation.

Submitted for publication April 1, 1958.

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Presented at the meeting of the Cincinnati Ear, Nose, and Throat Society, March 17, 1958.

Toynbee's Procedure

The following description of ear auscultation is a quotation from Toynbee's text.[4]

"In a paper read before the Medico-Chirurgical Society in 1853, I pointed out a simple methode of ascertaining whether the Eustachian tube was pervious. . .The entrance of air into the tympanum can be distinctly heard by means of an elastic tube about eighteen inches long each end of which is tipped with ivory or ebony, an instrument which I have named 'the Otoscope.' One end of it is to be inserted into the ear of the patient and the other into the ear of the medical man."

Toynbee emphasized the importance of ear auscultation. Besides providing information on the permeability of the tube it may be helpful in preventing dangerous positioning of the beak of the catheter outside the pharyngeal orifice. Figure 1 is a photograph taken from an illustration in Toynbee's text. It is essentially identical with the instrument which is generally used at the present time.

Shortcomings of Toynbee's "Otoscope"

There are some inconveniences inherent in the use of the Toynbee tube. Unfortunately the tipped ends of the rubber tubing, the so-called "ear olives," cannot be made to fit into all external meatuses. Therefore, the connection between these two parts is rather loose. Occasional slight involuntary and unavoidable movements of the patient's head or of the examiner may cause disconnection between the "olives" and the patient's

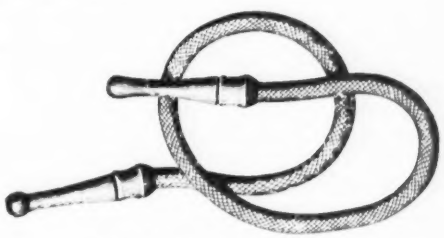

Fig. 1.—Toynbee's otoscope.

Fig. 2.—Twin phonoscope.

and/or examiner's ear. This interferes with the procedure.

This fact appears to have been appreciated by Toynbee since in describing his technique he says: "The surgeon is now to take the otoscope and introduce one end of it into the ear of the patient who may hold it there. The other end being held by the surgeon in his own ear. Or the tube may be made so tight as to remain there without being held there leaving the operator's hand free."

The "Twin Phonoscope"

The instrument (Fig. 2) consists of the metallic parts of two stethoscopes, including the springs. The two pairs of distal openings are connected with each other by one pair of rubber tubes with a length of about 18 in. The two halves of the instrument are mirror pictures of each other. The part to be inserted into the examiner's ears can be marked as such by a piece of adhesive. Spare "olives" can be stored under sterile conditions. The instrument is called "twin phonoscope" because of its "Siamese twin" appearance.

Advantages of the "Twin Phonoscope"

The following are some of the advantages associated with the use of the twin phonoscope:

1. It provides firm and undisturbed connections between "olives" and external meatus of both patient and examiner.

2. It dispenses with the active cooperation on the part of the patient which may hardly be obtained in the case of children or nervous (iatrophobic) adults.

3. It leaves the hands of the examiner free for handling the catheter and operating the Politzer bag or air pipe nozzle.

4. Simultaneous auscultation during politzerization of both ears makes comparison of the permeability of the tubes possible.

Summary

A new simple and inexpensive device providing significant technical improvement of ear auscultation during tubal inflation is presented. The instrument is named "twin phonoscope."

101 Louis Ave. (20).

Addendum

While I was reviewing the proof of my article, the November, 1958, issue of *The Laryngoscope* was placed on my table. To my amazement I noted the article of Dr. G. E. Arnold illustrated by a photograph of a "twin phonoscope," which he called a "differential salpingoscope." Beyond any doubt both Dr. Arnold and I had the same idea at approximately the same time.

It seems to me a rather amusing phenomenon worthy of the term intellectual superinsemination.

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Society Transactions

AMERICAN LARYNGOLOGICAL ASSOCIATION

Harry P. Schenck, M.D., President
James H. Maxwell, M.D., Secretary
Samuel Salinger, M.D., Abstract Editor
Seventy-Ninth Annual Meeting, San Francisco, May 19-20, 1958

Ground Substance in the Nose in Health and Infection. EUGENE S. HOPP, M.D., and HELEN F. BURN, M.S. (by invitation).

Hopp and Burn present the evidence thus far accumulated by themselves and others relating to the permeability of the ground substance in nasal tissues under varying conditions and the factors which permit certain bacteria to penetrate and spread. Spreading factors, notably hyaluronidase, seem to be more abundant in staphylococci than in most streptococci, which enhances their invasive potentialities. The hyaluronidase posseses the ability to depolymerize the hyaluronic acid in connective tissue, thus favoring the spread of infection. These findings resulted from comparative multiple stain techniques of serially sectioned biopsy specimens of turbinates from normal persons and from patients with infection. The authors conclude that since hyaluronidase is most active in the range of normal, slightly acidic nasal pH, the accepted concept of alteration of nasal pH to the alkaline side in nasal infection may be a defense mechanism and therefore the effect of the early stage of infection rather than the cause.

Discussion

DR. AUBREY G. RAWLINS brought out some of the relationships between the corticosteroids and the ground substance whose density is regulated by the pituitary-adrenal axis. The efficiency of this axis may be one determining factor in the invasiveness of certain organisms. Dr. Hopp has furnished good evidence that hyaluronidase-producing bacteria are often more invasive than nonproducers, and this would be an important factor in many nose and throat infections. The authors have shown how the spreading factor loosens the basement membrane under the epithelium, resulting in easier invasion by organisms.

Not much is known as to whether or not there is any spreading factor in the normal nose and throat mucosa. However, it must be assumed that its precursor is there, since the existence of hyaluronidase and mucolytic enzymes in the connective cells has to be postulated if equilibrium of the ground substance is to be explained.

DR. HOPP mentioned the antispreading factor of which there are two types; the antibody which is specific and the heparin-like substance which is nonspecific and is high in the blood stream in many diseases of a serious nature.

The authors have well emphasized the dual features of infection, namely, the virulence and the characteristics of the infecting organism and the quality of the ground substance of the host.

DR. GEORGE KELEMEN showed several electron microscopic slides of tonsil tissue which at high magnification (30,000) depict the elements in the collagenous material, the fibrillar structures, and the relationship of the epithelial cells to each other. Since these are joined together by intercellular bridges it can be seen how the lymphocytes have to push their way through by breaking down these bridges.

Electron microscopy can contribute much to our knowledge of tissue reaction to infection by bringing out the finer anatomic details of the various elements under varying conditions.

DR. HOPP in closing stated, in response to Dr. Rawlins' query, that in 1931 filtrates were taken from the normal nose as well as from persons having a cold, and it was demonstrated that there were spreading factors in the normal noses and, interestingly enough, there was an increase in the spreading factor in the patients with colds at that time.

DR. KELEMEN'S slides are most interesting and suggest the possibility of applying some of these histochemical staining techniques to the study of tonsil material.

Vocal Rest in Laryngeal Disease. MERVIN C. MYERSON, M.D.

Vocal rest must be intelligently applied and varies with the pathology in each case. It is of greatest value in acute cases where inflammation and edema predominate and less useful in chronic cases characterized by fibrosis and irreversible changes. Therefore it is of no value in the treatment of vocal nodules or in the chronic stages of

contact ulcer. It is useful in the preoperative days before removal of tumors and should not be prolonged postoperatively. Delay in permitting the patient to speak in some cases may lead to psychologic trauma. Within a very few days after surgery the voice may be used for moderate conversation, avoiding undue strain.

Discussion

DR. LOUIS H. CLERF agreed in the main with Dr. Myerson's conception of the role of vocal rest in laryngeal therapy. Contact ulcers will not disappear under this plan unless they are of very recent origin. In both vocal nodules and contact ulcer, speech therapy may be of some value, in addition to surgery when indicated. Pre- and postoperative vocal rest, particularly the latter, should not be prolonged. Voice use after operation should be permitted, since it prevents the heaping up of exudate and granulations and tends to a better anatomical and functional result.

DR. C. L. JACKSON favors moderate rest of the voice in the conditions mentioned by Dr. Myerson, but cautions the patient not to attempt talking against noises such as in traffic or busy offices. In the treatment of contact ulcer he believes there is a time and place for cautious use of the voice, but also it is important that the patient have the benefit of guidance under a speech therapist. Like Dr. Clerf, Dr. Jackson encourages patients who have undergone partial laryngectomy to begin using the voice as soon as it can be done without discomfort.

DR. HANS VON LEDEN said that electronic synchrostrobic examinations with high-speed photography can furnish much valuable information about the action of the vocal cords under varying conditions. On the basis of such observations he felt impelled to challenge Dr. Myerson's statement that certain lesions disappear in 24 hours. They may appear to the naked eye to shrink, but "one must consider the effect of the Bernoulli phenomenon on the vibration of the vocal cords before one draws any clinical conclusions."

DR. PAUL J. MOSES pointed out that voice rest is often advised in the expectation of curing a disorder, but frequently fails because of an underlying psychological problem which is the chief cause. Voice rest will not cure a vocal disorder that is due to emotional causes. It is therefore important in many cases that a psychiatric evaluation be obtained before any type of therapy is proposed.

DR. MYERSON closed the discussion with the following comments: Biopsies are usually not necessary in contact ulcers since it is known that carcinoma rarely occurs on the medial aspect of the arytenoid cartilage. As for raising the voice in the presence of noise, mentioned by Dr. Jackson, this can be avoided by using ear plugs as advised by Mr. Kantor. Since the electronic synchrostroboscope is not available universally, the laryngologist must depend on his clinical observations, and he personally can attest to a number of edematous lesions which have disappeared within 24 hours and with return of perfect function.

DR. MOSES' remarks are well taken and bring up the point as to what constitutes a qualified voice therapist. Many who claim this distinction have been found to be woefully deficient. Psychotherapy may well be the answer in many cases, but there are some patients of the exhibitionist type (such as a night club singer on whom he had operated, removing some vocal nodules) who refused to undergo proper voice therapy, and, with the recurrence of the nodules, blamed the surgeon.

Panel Discussion

Rehabilitation of the Postlaryngectomized Patient. JOHN J. CONLEY, M.D., Moderator.

Rehabilitation of the Postlaryngectomized Patient. CHARLES M. NORRIS, M.D.

Vocal Therapist: Place and Contribution to the Rehabilitation Program. PAUL J. MOSES, M.D.

Rehabilitation of the Postlaryngectomized Patient. F. JOHNSON PUTNEY, M.D.

Psychological Factors Determining the Success or Failure of the Rehabilitation Program of Laryngectomized Patients. BERNARD STOLL, M.D.

A Discussion of Some Technical Aspects of Speech Aids for Postlaryngectomized Patients. HAROLD L. BARNEY.

A New Surgical Technique for the Vocal Rehabilitation of the Laryngectomized Patient. JOHN J. CONLEY, M.D., and (by invitation) FELIX DE AMESTI, M.D., and MAX K. PIERCE, M.D.

DR. CONLEY introduced the members of the panel who were to discuss various aspects of the problems of rehabilitating the laryngectomized patient. These were to include surgical aspects, electrical equipment for voice production, and speech therapy. Some of these aspects have to some degree been overlooked in the past, and, although some progress has been achieved, further study may prove fruitful in resolving the problems which confront these patients.

DR. CHARLES M. NORRIS lists the deformities and disabilities likely to be encountered following extensive laryngeal and accompanying pharyngeal and neck resection. These are considered in two groups: First are those resulting inevitably from the surgery itself, such as permanent tracheostomy and loss of sensation due to section of branches

of the cervical plexus and of function of the trapezius from section of the spinal accessory.

The second group comprises deformities which may or may not be avoided, depending on the technique. These include stenosis of the stoma, stenosis of the hypopharynx, and paralysis of the mandibular, lingual or hypoglossal nerve. Also the effects of sectioning the jugular vein.

DR. CONLEY commented on the clear orientation of the operated area, the relative sizes of the wound, the demands on the local tissues and the resultant deformities. This demonstration should be valuable in assessing the surgical damage inherent in various procedures.

DR. PAUL J. MOSES discussed the emotional status of the patient prior to a laryngectomy and its influence on the postoperative rehabilitation. Restoring the ability to produce audible speech fails to compensate for the inability to transmit the nuances of feeling which no form of esophageal speech can duplicate. It is therefore important that the speech therapist be properly trained in the field of psychology and psychiatry in order to obtain the full background of the patient's personality and to be able to adjust him properly to the altered status of voice production. Placing him under the guidance of a laryngectomized patient who has mastered the technique of esophageal speech may fail unless the latter is qualified to understand and cope with a neurotic or psychiatric patient. It is also important that the surgeon keep in close contact with the patient during the postoperative period while under tuition by the speech therapist, since it is he who is responsible for having taken away the speech who must display the keenest interest in seeing that it is restored.

DR. CONLEY, hearing this paper for the first time, found it stimulating, provocative, and humanistic. The symbolism he attached to the "Adam's apple" as an attribute of virilism in the male may well explain the differing attitudes of the male and female when anticipating removal of the larynx. The high artistic and esthetic quality of Dr. Moses' presentation should be fully appreciated by all who are interested in the subject.

DR. F. JOHNSON PUTNEY, reviewing the postoperative records of 440 patients subjected to a laryngectomy at the Jefferson Hospital, found that 38% failed to develop a useful voice. The percentage of failures was higher in the female patients than in the male, owing to psychologic factors. The various techniques employed seemed to have but little influence on the ability to develop a voice, even when extensive removal of pharyngeal tissues, including the cricopharyngeus, was necessary. However, it was found that disturbance in the range of activity of the tongue and muscles of the floor of the mouth interfered with the ability to produce a voice as well as with the act of swallowing.

It would appear, therefore, from the analysis of this group of patients, that failure to develop a voice could not be attributed to extent of the surgery or the amount of tissue removed, with the exception of the item just mentioned.

DR. CONLEY called attention to figures presented by Dr. Putney where only 5.7% of 440 patients elected to use an artificial larynx. Comparing this with 38% of the cases that failed to become rehabilitated vocally, this is pretty much in line with the figures obtained at the National School for Speech Disorders in New York. It is interesting to note that no matter how much of the neck tissue is removed, rehabilitation is possible as long as you reconstitute the pharyngeal tube and preserve the muscles of the floor of the mouth and tongue.

DR. BERNARD STOLL, in attempting to evaluate the patient's attitude toward rehabilitation, enumerates the fears that beset most patients prior to and subsequent to operation. The degree of anxiety varies with the temperament of the patient, his vocation, position in society, and interpersonal relationship. Preoperative counseling by the physician will remove many of these fears, and the presence of an intelligent, psychologically astute person who has undergone a laryngectomy and has acquired a good esophageal speech is very helpful. Instruction within a group of laryngectomy patients lends psychologic support through the competitive element.

Necessity and willingness to learn are most essential and, as a rule, it has been found that the extrovert type of person adapts himself to the new regimen better than the introvert. It is important during the periods of instruction to avoid the use of the word "belch" because of its disagreeable connotations.

Psychologic conditioning whereby the patient acquires confidence in the ready acceptance by the public of his newly acquired speech is most helpful in instilling the necessary confidence.

DR. CONLEY stated that Dr. Stoll's paper illustrates very well the necessity for adaptation on the part of the patient in order to successfully master the technique. One can regard the patient as standing on a ladder. You either push him up into an area of greater success, if he has the adaptive capacity and necessary motivating principles, plus the support of proper schooling, or he will slip backward into failure to achieve adequate rehabilitation. If the speaking phenomenon can be made technically easier, the stratum is lowered, thereby putting it within reach of the patient's adaptive capacity.

DR. CONLEY apologized for the absence of the film which was scheduled to be shown, due to an

error on the part of the Phillips Company who sent a film on the palate instead of the esophagus.

Dr. Harold L. Barney, of the Bell Telephone Laboratories, analyzed the problem of constructing an artificial larynx that will meet certain mechanical acoustic and commercial requirements. Improvements have been achieved with the introduction of transistors and miniature batteries. However, the ideal has not yet been attained insofar as being able to produce speech patterns which will more closely simulate the normal. In order to obtain the full advantage of tongue, lip, and palate movements as well as the resonating chambers above, it would be necessary to introduce an air column as low down in the pharynx as possible. If this could be achieved through an artificial opening in the neck, it would be ideal, but there are certain hygienic and cosmetic considerations which are objectionable.

The author shows graphs which demonstrate the sound spectograms for certain vowels and consonants with the tube at different locations as compared with the normal.

It is anticipated that the Western Electric Model 2 device improved with proper acoustic and electronic circuit design should provide sufficient drive when applied to the outside of the throat to afford adequate intelligibility which will result in more natural-sounding speech.

Dr. Conley and Associates describe a new technical procedure whereby air can be conducted from the trachea to the esophagus for the production of controlled sound. It is accomplished by the construction of a mucosa-lined tube derived from the esophageal mucosa supported by one of the neck muscles and so directed as to be closed during the passage of food. The operation was performed on 11 patients, on 8 as primary procedures following the laryngectomy, and 3 as secondary procedures. Of the eight primary, three were technical failures (two of stenosis and one through fistula formation). The stenosis may have been due to removal of the catheter stent too soon. The fistula formation was in a patient who had had irradiation prior to laryngectomy.

In the successful cases the patients were able to speak with the first effort, and the quality of the voice was that of pharyngeal or esophageal speech but with better air control and supply and greater ease.

Discussion

Dr. Julius McCall called attention to his paper on "Preliminary Voice Training for Laryngectomy" of 18 years ago, which set in motion the development of what was termed "The Lost Chord Club." It is his contention that training for the esophageal voice should begin before and not after surgery. Also he disagrees with Drs. Moses and Stoll, who deny that the expulsion of air is not a burp or a belch. He can recall only two patients who were able to belch after laryngectomy who failed to develop a good esophageal speech. He agreed with Dr. Putney that the amount of tissue removed had little to do with the subsequent development of the speech.

Dr. Joseph H. Oguro had little to add, expressing his agreement with everything that had been said.

Dr. McNaught echoed the same sentiments.

Dr. Louis H. Clerf felt that, while the opinions expressed were in many respects most admirable, he could not agree with everything since some of them were diametrically opposed. It is generally agreed that the problem is one from which the surgeon cannot divorce himself. It is he who must take the initiative in getting the patient started, since it is he in whom the patient has the greatest confidence. He agreed with Dr. McCall to the extent that whether you call it belching or burping, you have to get air into the lower pharynx. Where the dividing line is located is difficult to say. He does not have the patient deliberately swallow but encourages him to relax during inspiration so that air may accumulate in the lower passages. He has himself been able to relax his cricopharyngeus sufficiently to fill the stomach with air.

Dr. Paul H. Holinger agreed with Dr. Putney that the type of operation has little to do with the subsequent development of a speech pattern. He believes that the most important factors are the motivation by the patient and intelligent cooperation of therapist and surgeon. Often it is a question of persisting too long in efforts to produce esophageal speech in some cases, to the point of frustration when such persons can more readily be made to accept an artificial larynx. With improved models of prosthesis this medium may become more acceptable. As to preoperative training, he disagreed with Dr. McCall because it is so often an individual problem. In some cases it only adds to the burden on the patient, who has many other things to attend to before undergoing surgery. Rehabilitation and inspiration to learn can begin before the patient leaves the hospital through association with others who have acquired speech and instruction by the therapist.

Dr. Conley agreed with Dr. Holinger that one of the most important psychological points is the compulsion of the patient to speak. It may be a good idea to give the patient a speaking apparatus at the outset as a means of encouragement toward adaptation.

Dr. Walter H. Hoover could not entirely agree that the type of operative procedure played no role in subsequent speech development. Certainly a flexible pharynx will adapt itself to voice produc-

tion better than one which is hampered by deep neck scars.

DR. CONLEY closed the discussion by stating that the purpose of the panel was not so much for edification as for a stimulus to all laryngologists and allied specialists to apply themselves toward the development of new techniques which may further the advancement of knowledge in this most important field.

The Changing Years: Their Impact upon the Management of Paranasal Sinus Disease. FREDERICK T. HILL, M.D.

Dr. Hill reviewed the changes that have taken place during the past 40 years in the management of sinus disease, showing how increasing knowledge of the physiology of the nose and sinuses and a better understanding of constitutional and environmental factors has led to a saner and safer attitude. He mentioned the excellent research and contributions of many of the members of this association which were responsible for the advances we have witnessed. He discussed the impact of allergy, endocrines, and other constitutional factors as they were developed within and without our specialty, whose influence on the course and development of sinus conditions was studied by our colleagues, resulting in a more intelligent understanding of the pathogenic processes. Surgical procedures have as a result tended more and more to conservatism, as demonstrated in his analysis of the treatment of frontal, ethmoid, and antrum disease. Comparing the widespread and often indiscriminate surgery of the sinuses formerly practiced on fallacious indications, with the modern conception of the sinuses as part of a total organism, it is easy to see why we are doing less surgery and obtaining better results under a comprehensive regimen which takes into account all of the contributing factors.

Discussion

DR. SAMUEL SALINGER confessed to an emotional reaction to Dr. Hill's presentation which was primarily a response to the realization that he was older than he had thought and, secondarily, to an amazing change in perspective.

Recalling, for instance, a meeting some years ago at which a colleague reported having done 300 intranasal frontal operations with a rasp, and with only one fatality, he is now shocked to think that at the time he was only impressed by the great skill of the surgeon without having given any thought to the question of why these operations were done.

To comment on the numerous items so ably assembled by Dr. Hill would be superfluous, but one or two personal observations are submitted. One should always be suspicious of any unilateral clouding of a sinus that is more than transitory, and should never be guilty of overlooking the possibility of a malignancy, which is so difficult to diagnose in the early stage. It is for this reason that he is a firm believer in the value of laminagraphs and x-rays with contrast media in every case that fails to yield promptly to conservative treatment.

Another conclusion to which he has been forced is that the only way to ensure against recurrence after frontal sinus surgery is to obliterate the cavity. He is impressed with the work of Bergara, who uses abdominal fat to fill the sinus and has presented evidence of subsequent development of fibro-osteoid tissue completely filling the space. In two recent cases, Salinger has used Gelfoam instead, and in following the cases with x-rays for several months has been able to observe a gradual obliteration of all bony landmarks. This may or may not mean a permanent filling, but only time will tell.

DR. FRANCIS L. WEILLE felt that the role of allergy has been overemphasized. Many people believe that the allergist can cure recurring polyposis with antiallergic therapy. He recalls a report by Dr. Schenck and Dr. Kern on a series of 700 cases, a third of whom had polypi, in which only four were cured by antiallergic therapy. He would like an expression from Dr. Hill on this point.

DR. HILL closed the discussion by stating first that he agreed with Dr. Weille as to overemphasis on the allergic factor, although he does see a number of cases in which this cannot be denied. Yet he doubts that polypi will disappear under allergic therapy except under the most unusual circumstances.

The subject of malignancies as well as complications was not presented, although both are included in the full paper to be published. As for Dr. Salinger's opening remark regarding the passing of time, he could only say that one thing worse than growing old is not having a chance to do so!

Surgery to the Nasal Lobule. HENRY L. WILLIAMS, M.D.

Dr. Williams described in detail the anatomy of the nasal structure with special emphasis on the relationship of the septum to the lateral and alar cartilages. Variations in the nasal apertures are responsible for varying effects on the degree of resistance to the inspired air which produce symptoms of hyper- or hypoventilation. The author points out that in most patients it is impossible to demonstrate the physiologic effects of these variations, and that from a practical point of view operations are indicated for the relief of subjective symptoms. He describes the symptoms caused by nostrils that are too narrow, deformities of the lobule, deviations of the lower portion of

the septal cartilage, variations in the size and placement of the lateral cartilages and nasolabial angles.

The procedures for correcting these manifold conditions involve a combination of techniques which may embrace the septum, upper lateral cartilages, and the lobule. The septum is dealt with through a modified resection with replacement of excised cartilage, and the lateral and lobular cartilage resected in part or cross hatched as indicated. These techniques were given along with appropriate illustrations. Good functional results can be obtained only through careful study of the individual case, applying only those remedial measures which are strictly indicated.

Discussion

DR. G. EDWARD TREMBLE describes the anatomic differences between the nares of the Caucasian as compared with the Negro and the Filipino, which account for differences in the direction of the air flow within the nasal passages. These are to be taken into account when surgery is to be undertaken which involves changes in the contour of the nares and vestibule, so that the normal pattern of air flow is not to be altered. The shape of the nares must conform to the normal Caucasian, when one is operating on a white person, and the vestibule must retain the normal valve of Mink so that the air current is properly directed.

Frequently after a properly performed submucous resection nasal blockage will be complained of, which can easily be corrected by a simple procedure on the lobule.

DR. SAMUEL SALINGER felt, since Dr. Williams had introduced the subject of the septum in his consideration of deformities about the lobule, that he would like to comment on that aspect of the problem. He has long been an advocate of a conservative type of operation in which the deformity is corrected with removal of a minimum of cartilage and bone. Others have had the same idea, and a variety of procedures have been described by Stevenson, Dingman, Becker, and Malimak, as well. In all these techniques the Metzenbaum procedure has been more or less modified, the objective being the straightening of bends, curves, and angles through limited excision and through repositioning of the liberated cartilage. The point is that no single technique is applicable to all cases and that success depends on the ingenuity and technical skill of the individual operator.

DR. IRVING GOLDMAN called attention to the varying shapes of the nares to be found in different races and the question as to how much influence they exert in the respiratory function. Changing the shape of the lobule may be applicable in one type and disastrous in another. In the combined septum rhinoplasty with surgery of the lobule, he is convinced that the causative factor is most generally to be found in the septum, and he agrees with Dr. Salinger that conservative procedures will yield the best results.

DR. JUERGEN TORMDORF disagreed with Dr. Tremble in his statement that there is a substantial difference between the currents of inspired and expired air. Experiments of older authors did make this claim, but it was found that the difference was due to use of too heavy material. It was disproved 20 years ago in Dr. Proetz' experiments. He also may have misunderstood Dr. Tremble as saying the current slowed down as it goes through the vestibule. On the contrary, when a current of air passes through a narrow opening, its velocity has to increase. The third point refers to the eddy motion of the air which through the nose is more laminary and unstable. If you calculate the Reynolds' number which indicates whether the motion will be laminary or eddying, then it turns out that the Reynolds' number for the nose is about 1,000 in eddying. It starts at 1,100 or 1,200. This means that you are just short of eddying, and if your surgery does anything to speed up the flow of air you will produce an eddying current.

DR. WILSON stated that we are led to believe the Caucasian nose is narrower than the Negroid type because of living in colder and dryer climates. Could Dr. Williams offer any explanation of the shape of the Eskimo's nose?

DR. WILLIAMS closed the discussion by first answering Dr. Wilson's query to the effect that not being privy to the designs of the Lord, he was unable to offer any explanation, nor did he believe the anthropologists could.

As to the remarks of Drs. Salinger and Goldman, the technique he has described here offers great flexibility and permits surgery in the lobule at the same time. He agrees that there is no set technique.

The question as to whether the various types of noses have to do with varieties of obstruction is beyond the point. Patients come to the surgeon because of obstruction, and in many instances the submucous resection is inadequate and a better result can be obtained by additional surgery on the lobule.

What the mechanism of obstruction from lobular deformities is he would leave to mathematicians such as Dr. Tormdorf, but the fact of the matter remains that the patients are relieved of their complaint when the deformities are properly corrected.

Carcinoma in Situ of the Larynx: A Ten-Year Study of Its Histopathological Classification, Prognosis, and Treatment. ALDEN H. MILLER, M.D., and H. RUSSELL FISHER, M.D.

Miller and Fisher, analyzing a series of 48 patients with carcinoma in situ of the larynx, ob-

served during a 10-year period certain data pertaining to classification, local characteristics, invasive potential, and results of therapy. Of the three histologic types encountered, basal-cell, squamous-cell, and Bowmanoid, the most common was the squamous-cell which appeared to be associated with leukoplakia. Ten patients developed invasive carcinoma, most of them originating from the squamous type. Treatment by stripping, laryngofissure, or x-rays was individualized on the basis of extent of the lesion, original diagnosis, and development of recurrence. Laryngofissure was successful for the small lesions. More extensive lesions, especially the bilateral, received x-ray therapy, which obviated the need for laryngectomy in 17 of 23 patients.

There was only one death following laryngectomy with subsequent invasion of the lymphatics and a radical neck dissection.

Discussion

Dr. Francis E. Le Jeune brought out the point that the clinical picture of carcinoma in situ was not characteristic and that its differentiation from invasive carcinoma could be determined only by the pathologist. The question as to whether the lesion has penetrated the basal membrane can be resolved only through serial sections, and since it is impractical to examine all the sections in a given specimen it is possible that some invasive cases may escape detection and thus account for recurrences.

He has found carcinoma in situ ideal for removal by suspension laryngoscopy with wide excision followed by electric coagulation of the base. Dr. LeJeune inquired of Dr. Fisher as to why he found it necessary to use the words "without invasion" in referring to these growths, since penetration of this barrier changes the picture and one is now dealing with an invasive carcinoma and not a carcinoma in situ. Also he would like Dr. Miller to explain why he was impelled to do laryngofissure in some of these cases.

As to statistics, he has not had an opportunity to review his own but is under the impression that he had seen very few recurrences.

Dr. Eugene S. Hopp suggested a possible explanation for invasion which might reconcile the points of view of Drs. LeJeune and Fisher, namely, that invasion and even metastasis depend on the integrity of the ground substance. Some excellent work has been done showing that metastases develop where depolymerization of ground substance has taken place. It would be interesting and profitable to do histochemical stains on these carcinomas with the idea of ascertaining whether the ones which subsequently developed extension or invasion showed this depolymerization in the sections and whether the ones which did not develop showed intact ground substance.

Dr. Julius McCall would view carcinoma in situ as an unpredictable lesion. As stated by Dr. LeJeune, much depends on the area from which a biopsy specimen is taken, since a distance of a few millimeters may produce an entirely different picture. This was illustrated in pictures shown by Dr. McCall of a case where one section showed intact basement membrane, whereas another showed a break-through.

Dr. Miller closed the clinical side of the discussion by stating that he had attempted to make the distinction between the strictly intraepithelial growths and those showing invasion, the latter being excluded from the series, if recognized.

Regarding the potentially malignant character of these lesions, Dr. Miller agrees with Dr. LeJeune that every case is potentially invasive although in many cases the invasive character is not manifested until years later. Initially, a clinical diagnosis cannot be made from the appearance of the lesion, many cases being leukoplakia cases on the surface.

Dr. Fisher explained his terminology "without invasive carcinoma" to emphasize that all parts of the tissue had been examined. He may perhaps have been too redundant for this audience, but has so often been asked "was there not invasion in some other part" that as a result it has been his habit to add the words "without invasive features."

The point brought up by Dr. Hopp is an important one, and it must be conceded that the character of the ground substance has much to do with the chances of invasion. He has made studies in a few cases but not systematically. Alterations in the ground substance have been observed in simple keratosis, and chronic laryngitis, as well as carcinoma in situ without, however, revealing any specific change characteristic of carcinoma in situ. Dr. McCall's case brings to mind the studies on carcinoma in situ of the cervix in which a potential invasion has been more or less fixed. By comparison the cases involving the larynx occupy a place midway between the peak age of cervix lesions and keratosis and is estimated at about eight years. Dr. McCall's slides demonstrate the difficulty that arises when only one section is examined. One slide appeared to be simple metaplasia; another showed carcinoma in situ at one spot, and another showed it with invasion.

Bronchoscopic Findings in Tuberculous Children (a Fifteen-Year Study). David E. S. Wishart,† M.D., and J. B. Whaley, M.D.

(Owing to the untimely death of Dr. Wishart, this paper was presented by Dr. Whaley.)

† Dr. Wishart died April 8, 1958.

Wishart and Whaley describe the results of their bronchoscopic examinations of 144 children with bronchial tuberculosis. Many of these had bronchograms as well and a total of 273 examinations were made. The authors give the details of the procedure, which is carried out under general anesthesia in a properly ventilated room with shock- and explosion-proof apparatus.

Primary bronchial tuberculosis was found in a limited number of cases, the result of direct infection of the mucosa, which revealed redness and swelling over a limited area. Most commonly the upper lobe bronchi and the lingula were affected.

Secondary tuberculous bronchitis was found more frequently and often called for emergency treatment. Compression of a bronchus due to pressure of enlarged glands was a common finding, and frequently there was an accumulation of caseous material and granulations due to rupture of a caseous gland into the lumen. These called for bronchoscopic removal. Other findings were bronchiectatic lesions of the "flagellate" type.

Following unsuccessful trials with streptomycin, para-aminosalicylic acid (PAS) and isoniazid (isonicotinic acid hydrazide [INH]) proved more successful. Repeated bronchoscopic aspiration with removal of granulations was helpful in many cases. In a few it was necessary to resort to lobectomy and occasionally to pneumonectomy.

Numerous pictures showing bronchograms illuminated the presentation.

Discussion

Dr. Mervin C. Myerson has found that the age group below 2 years is the worst from the standpoint of prognosis. In the group between the ages of 4 and 14 about 15% to 20% present the type of lesion seen in adults. In the infant and young child the glands cause the most trouble, often to the point of obstructing the bronchi. These glands may develop in two directions, one being erosion into a bronchus, the other being by lymphatic extension to the bronchial mucosa. This may be either a submucous infiltration or an open ulceration. Dr. Myerson showed slides depicting lesions in the parenchyma and showing the manner of extension to the bronchi. Generally speaking, one may safely attempt to remove a granuloma, but if the lesion is caseous surgical trauma might precipitate a miliary spread to other parts of the body. Also Dr. Myerson would not recommend dilating a bronchial stenosis because of a hematogenous spread.

Dr. J. P. Atkins has found that it is safe to remove endobronchial caseation debris without danger of dissemination, probably owing to the effectiveness of the antibiotics, and the improved ventilation is certainly beneficial.

Dr. Whaley, in closing, agreed with Dr. Myerson that many cases do not respond to endobronchial therapy and have to submit to surgery. As for the caseous lesions, he agrees that cautious removal of the debris is desirable, while, on the other hand, as Dr. Myerson pointed out, dilation is risky.

The Clinical Significance of the Anatomical Arrangement of the Paranasal Sinuses. Fred W. Dixon, M.D.

A study of 200 wet specimens by Dixon yielded a number of observations which have proved of value in surgery of these areas. These include the accessibility of the middle meatus for irrigation of the antrum, the variations in size and disposition of the ethmoid cells, the variations in size and relative positions of the two frontal sinuses, and the extreme variability of the sphenoid sinuses. Dr. Dixon points out the value of closely observing the fovea ethmoidalis, which is an excellent landmark in performing surgery on the ethmoids via the intranasal approach. Preserving as much as possible of its mucosa, plus that which covers the superior and supreme turbinals, and as much as possible of the middle turbinate will prove valuable in avoiding complications.

Recurrence of polypi can be expected if the surgery is incomplete and in allergic individuals. A résumé of 290 intranasal ethmoidectomies showed 25% with recurrences, mostly in allergic cases and in patients who rejected complete removal.

Discussion

Dr. Walter P. Work stressed the points brought out by Dr. Dixon relating to the variations of the frontal sinuses. In narrow frontal sinuses it is extremely difficult to preserve a functional frontal duct. The chances are better in cases where the anterior dimension of the sinus is greater. Surgical treatment of the frontal sinuses must of necessity include associated surgery of at least a portion of the ethmoid labyrinth, and here a knowledge of the disposition of the cells is of great value.

Dr. Work has found that serious complications were most frequently encountered in the allergic cases, and inquired of Dr. Dixon whether this has been his experience also.

Dr. Barry J. Anson, as an anatomist, expressed his appreciation in having been able to hear two papers dealing with the morphology of the sinuses. At the onset of the antibiotic era he had been led to believe that the mention of sinusitis would be an anachronistic act. Now that it has appeared that sinusitis still exists despite antibiotics, he fears curricular encroachment by clinical courses on the time formerly available for preclinical courses. In his department he has

already lost 30% of previously alloted time. Since it is apparent that hours must be recaptured for teaching anatomy, the pressure and influence must come from the clinicians. Meanwhile postgraduate lectures of the type presented here are a refreshing and helpful addition to make up for deficiencies in the undergraduate instruction.

DR. W. LIKELY SIMPSON described his approach to the frontal sinus through the floor with complete removal of all mucosa and all septa between the frontal and the ethmoids. Visualization of all parts of the large sinus is accomplished with the use of small mirrors. No irrigation is practical, and only a small gauze is left under the middle turbinate, which is removed on the third day. No further drainage is employed since there is no nasofrontal duct left, the fronto-ethmoid cavity being all in one.

DR. FRANCIS W. DAVISON complimented Dr. Dixon on his paper and called attention to a previous presentation of this which was given at the Eastern Section of the Triological Society, which he considers a classic. He inquired as to when and where this was to be published.

DR. KINSEY M. SIMONTON called attention to Dr. Dixon's reference to removal of the middle turbinate which has been invaded by a cell. He has found it practicable to remove only one wall, thus leaving the other for physiologic functioning.

DR. DIXON closed the discussion by first replying to Dr. Simonton. It is his practice to leave as much of the turbinal structure as possible on the side facing the septum. This has proved helpful in preserving the olfactory sense.

The article mentioned by Dr. Davison will appear in the *Annals*. He agrees that the operation for removal of polypi should be done in the hospital, where a more thorough job can be accomplished. Also he agrees with Dr. Simpson that thorough removal of all of the tissue will yield the best results.

Dr. Anson's point is well taken. We need more teaching of anatomy and pathology at the undergraduate level.

About swimming, he feels, like all rhinologists, that it should be interdicted for all patients having chronic sinus trouble.

As to indications for the operation, it should be required in all cases where ventilation and drainage has failed, and where irreversible changes have taken place.

Orbital Apex Syndrome. AUSTIN A. SMITH, M.D.

Dr. Smith described the orbital apex syndrome as the clinical manifestation of a lesion which affects the nerves and vessels that pass through the optic foramen and sphenoid fissure. The chief symptoms are severe temporoparietal pain, impairment of loss of vision, ptosis, and ophthalmoplegia. The condition may be due to infection, neoplasm, or trauma, and can originate either in the retro-orbital region or in the posterior sinuses. Five cases are cited, one being due to a severe upper respiratory infection, one to a posterior sinus infection, a third to a carcinoma originating in the ethmosphenoid area. The fourth was a complicated case which, after careful study and radical surgery, proved to be an extensive involvement of all the sinuses in a gangrenous destructive process with necrosis apparently due to endarteritis and thrombophlebitis. The last case was due to trauma resulting from a fall from a ladder.

The clinical history of these cases affords an interesting study in diagnosis and therapy.

Discussion

DR. OLIVER E. VAN ALYEA pointed out some of the anatomic features of the orbital apex, explaining the symptomatology.

The complete syndrome as described by Dr. Smith is fortunately quite rare, but an uncomplete syndrome may be commoner. Two cases are cited, one being due to an aneurysm of the internal carotid artery and the other to a retrobulbar cyst. This latter patient, a girl of 13, after drainage of the cyst still persisted in having severe headaches and a mild ptosis. Surgery on the affected ethmoid was advised, but rejected by the parents on religious grounds. Dr. Van Alyea asked Dr. Smith how he would proceed in such a case.

DR. SMITH replied to Dr. Van Alyea's question by calling attention to the necessity of having the cooperation of the neurologist, ophthalmologist, neurosurgeon, and x-ray man. Too often, however, the case goes from internist to ophthalmologist and neurologist and x-ray man without consultation with the rhinologist, because the possibility of a sinus involvement is overlooked. This may be due to the fact that antibiotics have often been considered as having eliminated sinus disease. This is indeed a grievous error. In the particular case mentioned by Dr. Van Alyea, every effort should be made at least to cautiously explore the ethmoids.

Physiology of the Larynx Under Daily Stress. PAUL G. MOORE, M.D., and HANS VON LEDEN, M.D. (by invitation).

Drs. Moore and von Leden demonstrated the action of the vocal cords in a slow-motion film which reveals their responses under daily stress. Numerous subjects were checked and rechecked to ensure the accuracy of their interpretations. Two new ideas ensued following a study of the film, which seemed to alter previous concepts of the physiology of the larynx.

1. The old concept that the cords open faster than they close is not true. Opening and closing phases are related to the intensity of the voice.

2. The larynx is capable of biphasic movements, which to date had been considered impossible.

It is hoped that these studies will lead to a better understanding of the frequently observed disparity between the degree of hoarseness and the objective findings in the larynx, and point the way toward a more rational treatment of early larynx disorders.

Discussion

Dr. John A. Murtagh expressed his admiration for the film just shown, which he appreciated all the more because of some experience with a high-speed Fairchild Industrial Motion Analysis camera which he had been using in an effort to evaluate the basic physiology of the larynx in animals. He confessed that his films could not compare with the one just shown. This type of work should be encouraged because so much can be learned which was previously unexplained.

Dr. von Leden stated that it is at first difficult to accustom oneself to veiwing these pictures, but that after they are seen frequently many new factors can be seen and understood.

The Management of Chronic Laryngeal Stenosis. Paul H. Holinger, M.D., and Kenneth C. Johnston, M.D. (by invitation).

Holinger and Johnston reviewed their experiences in 163 cases of chronic laryngeal stenosis over a period of 10 years. Of these 61 were congenital in origin; 43 were inflammatory, and 57 were traumatic. Each of these types is described and illustrated by a typical case. The authors have noted recently a decline in the percentage of cases due to inflammatory processes, and an increase in the number of post-traumatic lesions. They point out the importance of early attention to fractures of the larynx in the prevention of subsequent stenosis from scarring and maladjusted cartilage. Tracheotomies were performed in 138 of the 163 cases, and dilatations were carried out in 123.

They also call attention to the value of voice therapy in the development of proper phonation and respiratory control.

Discussion

Dr. Daniel C. Baker, Jr. has found that long-continued bougienage in children is frequently disappointing. In adults it is difficult because of the pain and discomfort which cannot always be avoided even with local anesthesia or nerve block. Rubber core molds, as suggested by Jackson, are irritating and cause considerable laryngeal reaction. McNaught's keel is excellent for web stenoses, especially the acquired type. This is frequently the result of using the cautery, and he is in agreement with Dr. Holinger, who advises against it. The stent graft as described by Fifi has been most useful when followed by the acrylic mold.

Dr. Holinger's experience with traffic injuries is most valuable and his suggestions for their management extremely important.

Indwelling catheters for feeding in some tracheotomy cases will often delay decannulization because of reaction in the larynx due to the tube.

Four cases of necrosis of the thyroid cartilage with resulting draining fistulae over a period of years were cured only after surgical removal of the diseased cartilage.

Dr. Holinger's presentation may well serve as a proper guide in the management of laryngeal stenosis of the chronic form.

Evidence of Laryngeal Participation in Emotional Expression: Its Relation to Hysterical Aphonia. A. C. Furstenberg, M.D.

Experimental electrical stimulation of various cerebral areas in the monkey have demonstrated secondary motor areas which may activate laryngeal movements. These have separate and distinct pathways to the nucleus ambiguus and can carry impulses eliciting laryngeal movements even in cases of supranuclear laryngeal paralysis. The secondary motor areas are in fields which on stimulation result in homolateral movements of the facial muscles, jaw, and tongue. Theoretically, therefore, it should be possible to train the larynx to function in patients with supranuclear lesions which have produced bilateral laryngeal paralysis.

It was also found that some of the additional motor areas are in fields which have to do with emotional responses. This has been demonstrated in a case of hysterical aphonia. The patient, when aroused, may scream loudly and even speak audibly.

It is also probable that the additional motor areas of the larynx, like those of other types of movements, serve as centers for automatic associated movements, as illustrated by unaware whistling, humming, and talking to oneself.

It is assumed on the phylogenetic basis that these experimental findings in monkeys represent a similar pattern in the human.

Discussion

Dr. Stanton Friedberg recalled some of Dr. Furstenberg's previous papers on the subject of laryngeal innervation, in which the role of supranuclear lesions in the production of laryngeal paralysis was demonstrated. His present contribu-

tion gives strong experimental evidence of secondary motor areas supplying pathways to the nuclei which can activate laryngeal movements. While Penfield and Rasmussen demonstrated laryngeal movements through stimulation of the human cortex at surgery, it remained for Dr. Furstenberg to demonstrate and record them photographically and then study the postmortem specimens of cortical areas stimulated.

The emotional connotations of hysterical aphonia as explained by Dr. Furstenberg may not be the only factors, since Jackson hinted long ago that an "ephemeral adductor paralysis may be due to sudden anemia of the anterior cerebral cortex as in syncope or fainting." However, this has not been proved by anatomic or physiologic studies. Dr. Furstenberg's suggestion that stimulation or inhibition of hypothalamic areas concerned with emotional expression may stem from certain definite regions of the brain could supply the physiologic evidence to explain hysterical aphoria.

Abstracts from Current Literature

Ear

SURGERY OF THE WINDOWS OF THE LABYRINTH IN OTOSCLEROSIS. MICHEL PORTMANN and GILBERT CLAVERIE, Ann. Otol. Rhin. & Laryng. 66:49 (March) 1957.

The authors perform surgery on the round window, the stapes, and the oval window in otosclerosis as warranted by operative microscopic findings. Round window surgery, when indicated, consists of removal of the diaphragm and fibrous blocks by small curettes and spatulas especially devised for this purpose.

In many cases, the stapes can be mobilized by action on its head. In some instances, because of exostosis at the level of the oval window and crural atrophy, a more direct attack is required. Pressure directly on the footplate is sufficient in some cases; others require dislocation of the incus and stapes to permit more direct force to be brought to bear on the stapedial head.

The authors use a special microdrill, measuring 0.2 mm. in diameter, turning at 8-10,000 rpm in order to make a series of perforations around the footplate in cases showing massive ossification. Mobilization of the stapes is thereby facilitated.

Occasionally it is necessary to completely remove the stapedial footplate, so as to effect a true fenestration of the vestibule at the most suitable location. The tympanomeatal flap is then laid over the oval window.

Of 80 patients operated upon by the authors, 60% received appreciable gains in hearing, ranging from 10 to 55 db. At times there was a complete restoration of the Rinne test and a normal level of hearing.

STEELE, Kansas City, Kan.

PHYSICO-CHEMICAL PROCESS IN THE HAIR CELLS OF THE ORGAN OF CORTI. O. MIZU KOSHI, T. KONISHI, and F. NAKAMURA, Ann. Otol. Rhin. & Laryng. 66:106 (March) 1957.

The hair cells of the organ of Corti from guinea pigs were studied by cytochemical analysis and cochlear microphonics in acoustically quiet conditions, after acoustic stimulation, and in various stages of quinine or dihydrostreptomycin intoxication.

In the normal animal, cochlear microphonics shows signs of recovery after overstimulation with sound at 4,000 cps and 90 db. intensity lasting three minutes.

Early intoxication was shown in the hair cells nuclei as an increase of nucleolus-associated chromatin and pyknosis. With moderate stimulation, the recovery time is prolonged and its behavior indicates a definite cumulative decrease in the speed of physicochemical reconstruction in hair cells. However, complete recovery for cochlear microphonics is always found, showing reversibility of the cytochemical changes.

In the late stages of intoxication with dihydrostreptomycin, the cytochemical changes in the hair cells range from karyorrhexis to complete karyolysis, and the arrangement of the outer hair cell nuclei is irregular. Moderate stimulation can then easily produce permanent damage, and recovery after overstimulation is generally incomplete.

STEELE, Kansas City, Kan.

ANATOMICAL ETIOLOGICAL FACTORS IN CHRONIC MIDDLE EAR DISCHARGE. MARCUS DIAMANT, ANN. OTOL. RHIN. & LARYNG. 66:380 (June) 1957.

Diamant of Sweden presents a study of the etiology of tympanic membrane perforation as related to mastoid air cell development in which 1,600 individuals were otoscopically and radiologically examined. The area of mastoid air cell system was measured with a planimeter, permitting an exactness of 10 sq. mm.

Two alternatives which explain the anatomical size variation of mastoid air cell systems are the anatomical factors and the pathologic conditions. Therefore, the small air cell system is the most controversial size. Hypothetically, the pathological small air cell system may develop by a halting of growth before or during development and by diminution of the already developed large air cell system. However, the commonly held view that small air cell systems occur by means of pathological stunting of growth appears to lack scientific support and it is believed the anatomical view is more correct, i. e., all sizes of air cell systems are anatomical in nature.

The size of air cell system and development of tympanic membrane perforation are closely related, in that it is observed that no perforation was encountered in ears with air cell systems exceeding the mean size of 15 sq. cm. While air cell systems falling short of the mean size do not necessarily show perforation, the central perforations were found only in systems smaller than 15 sq. cm. and marginal perforations only in systems under 10 sq. cm. in size. Asymmetry in air cell systems was commonly encountered, but was not necessarily associated with perforation. However, when perforation was present in such individuals, it always occurred in the smaller air cell system.

It is concluded that the size of the mastoid area measured, or the volume of the mastoid air cell system, is not itself a causative factor in the pathogenesis of the tympanic membrane perforation. The area measured only serves as a fairly reliable indication of the pathogenetic possibilities and seems to be of prognostic and diagnostic value. It may also be of value in assessing the therapeutic effect of various methods of operation.

STEELE, Kansas City, Kan.

SUDDEN PERCEPTIVE DEAFNESS AND VIRAL INFECTION. H. A. E. VON DISHOECK and T. A. BIERMAN, Ann. Otol. Rhin. & Laryng. 66:963 (Dec.) 1957.

Studies were performed on 100 patients who suddenly or in a few days developed unilateral or bilateral perceptive deafness. The authors state that in their native Netherlands, virus infections, especially mumps, is a common cause for sudden perceptive deafness. In nearly half the 100 patients, the etiology remained obscure but it is possible that a high incidence of viral infection may not be unusual in this group. It is estimated that the incidence of sudden perceptive deafness due to viral infection in the population of 1,000,000 in Holland may be 200 cases each year.

STEELE, Kansas City, Kan.

EFFECT OF SHORT-TERM HYPOTHERMIA ON COCHLEAR RESPONSES. C. FERNÁNDEZ, H. SINGH, and H. PERLMAN, Acta-otolaryng. 49:188 (May-June) 1958.

This group of experiments involved the production of hypothermia from 38-20 C in anesthetized guinea pigs. Using differential electrodes connected to and recorded from the first turn of the cochlea, cochlear microphonics CM and action potentials N_1 and N_2 were noted. During the temperature drop of 18 degrees centigrade the latency of the CM remained constant. This suggests that the mechanism that precedes the generation of these microphonics is not sensitive to impaired metabolism. In the record of the action potentials it was determined that they showed changes in amplitude and shape comparable to those shown by peripheral nerves. Both the threshold and the amplitude of the cochlear microphonics varied together. There were consistent observations of losses of 12 and 8 db. During warming, the reversibility of all these parameters lagged. This suggested that the cooling process probably caused transient alteration in the cell metabolism, thus slowing the resetting of the generators of cochlear potential.

As the temperature dropped, resistence of cochlear microphonics and neural components to asphyxia increased. This indicated that the oxygen reserve of the tissue and circulating blood was sufficient to prolong the survival of the generators when their metabolic rate was reduced.

LEWY, Chicago.

RESORPTION OF THE CEREBRO-SPINAL FLUID IN THE GUINEA-PIG. V. SVANE-KNUDSEN, Acta oto-laryng. 49:240 (May-June) 1958.

Using the method of Weed, in a series of histological studies the author studied the pathways of resorption of cerebrospinal fluid. Although the complete picture of this process cannot be presented, he feels that the available evidence justifies the following general conclusions.

Resorption and production of cerebrospinal fluid take place with astonishing speed. Loci of resorption are in the subarachnoid space and its extensions between the lobes and gyri of the brain to the small vessels. Evidence of resorption through the Pacchioni granulations is limited to a single observation; therefore its extent is not determinable in this study. A steady stream of fluid goes through the aqueduct to the perilymphatic space. The perilymph is resorbed partly to small vessels in the lateral wall of the scala tympani. Part seems to be given off again in the deep part of the spiral ligament to form a reservoir for the supposed secretory

function of the stria epithelium. Some fluid follows the acoustic nerve to the modiolus, the sheath of the optic nerve, and the olfactory nerves. Some of the last-mentioned may moisten the free surface.

LEWY, Chicago.

A CLINICAL CONTRIBUTION ON THE PATHOGENESIS OF DROPSICAL PROCESSES OF THE INNER EAR. F. K. WILDHAGEN, Acta oto-laryng. 49:256 (May-June) 1958.

The author states that inner ear influences caused by structural disturbances of the cervical vertebrae and consequent effect on vertebral arteries and nerves is already established, that there is cervical genesis of labyrinthine dysfunction. Findings of cervical disc prolapse and the responses to stellate ganglion block and vasodilatation in this region tend to support this concept. Endolymphatic dropsy is the end-effect of the disturbed physiology. Quoting verbatim, "The dropsical processes of the inner part of the ear conditioned by changes of the cervical vertebra through a segmental vascular injury indicate for the first time an uninterrupted pathogenetic process and only they are able to explain the localisator-effect of the labyrinthine dropsy."

ABSTRACTER'S COMMENT: If there is substance to the author's argument, I don't believe that it is proved by the evidence he uses . . . this seems to have chiropractic overtones.

LEWY, Chicago.

OTITIS IN INFANTS AND GAMMAGLOBULINEMIA. A. J. M. ROCA DE VINALS, R. V. LARDENT, and R. ROCA DE VINALS, Acta oto-rino-laryng. 9:5, 1958.

The authors present a series of three cases of otitis media in infants that resisted the usual methods of treatment. These included repeated paracenteses and intensive antibiotics. A proteinogram showed a marked decrease or total absence of gamma globulin. The institution of transfusions of plasma rapidly cured the infants. The authors stress the importance of evaluating the plasma protein in all obstinate cases of otitis.

PERSKY, Philadelphia.

ATTICO-TYMPANIC PROFUSION FOR CONDUCTIVE DEAFNESS. M. C. SAGRE, Acta oto-rino-laryng. ibero-am. 9:43, 1958.

The author describes his technique (a modification of the Curotto Costa procedure) for intratympanic perfusion of the middle ear cavity with hyaluronidase and hydrocortisone acetate in cases of conductive deafness, particularly of the adhesive type. After a complete anesthesia of the external canal and the tympanic membrane, he injects 0.75 cc. of hyaluronidase containing 10 units per cubic centimeter of solvent. A sound is then inserted in the Eustachian tube. Then 0.75 cc. of hydrocortisone acetate in a concentration of 25 mg. per cubic centimeter of solution is injected into the tympanic cavity through the site of the initial injection. This second procedure is made a half hour after the initial injection.

The procedure is innocuous, very simple to perform, and has produced an improvement in 80% of his cases. He recommends it in all cases of conductive deafness that have failed to respond to the usual therapeutic measures.

PERSKY, Philadelphia.

PLATINOFISSURE WITH OR WITHOUT STAPEDOLYSIS. P. CLERC, Ann. oto-laryng. 75:220 (April-May) 1958.

Certain factors influence the success of the stapes mobilization operation for otosclerosis. Among these are the following: 1. The mobility of the stapes. 2. The condition of the cura. If these are thin and fragile, manipulation would cause their fracture. Another factor is the exact site of the attachment of the posterior crus to the footplate. This varies in each case. The importance of this is to gauge properly the amount of space between its insertion and the free edge of the footplate. 3. The appearance of the footplate—its points of attachment, its thickness (whether it is atrophic or thickened). 4. The depth of the oval window. 5. The condition of the mucoperiosteum, the round window, and the tympanic cavity.

In a series of 300 cases, Clerc's groups are as follows: (1) a subnormal stapes and footplate, 5%; (2) large atrophic footplate with an anterior ankylosis, 70%; (3) small atrophic footplate with an anterior and posterior ankylosis, 15%-20%, and (4) a thickened or hypertrophic footplate with firm extensive ankylosis, 5%-10%.

The operative procedure varies with each group. In Group 1 Clerc uses the "timbre poste" technique. He places a fine sharp stylet in the gulley between the footplate and oval window

and taps this with a mallet. He makes a series of these perforations a few millimeters apart until he obtains a free mobilization. In Group 2 he performs a footplate fissure with a stapedolysis. The anterior crus is first fractured, and then follows with the above technique. Usually after the second or third blow of the mallet, the footplate is fractured, and the stapes becomes mobilized. In certain cases it may be necessary to fracture the posterior crus. In Group 3 he uses either the above technique or the Rosen transpalatine fenestration. In Group 4 the transpalatine fenestration is used.

The results of the above procedures are good in 80% of cases, namely, an improvement of 30-40 db. in the critical frequencies. In 90% of his cases, Clerc was able to mobilize the stapes. His failures were due to inability to mobilize the footplate and postoperative problems such as reankylosis and fibrous blockage of the oval window.

PERSKY, Philadelphia.

Larynx

RECONSTRUCTIVE METHODS FOLLOWING LARYNGOPHARYNGECTOMY. G. KENNETH LEWIS, MAURICE F. SNITMAN, and ARTHUR LOEWY, Ann. Otol. Rhin. & Laryng. 66:88 (March) 1957.

The authors outline the various reconstructive surgical methods they have found useful after laryngopharyngectomy for extensive laryngeal cancer. It is stated that, by so doing, they have been able to salvage many patients formerly relegated to inadequate surgery or debilitating radiation without complete eradication of the malignant disease.

When palpable lymph nodes are demonstrated preoperatively, a laryngopharyngectomy with unilateral neck dissection is performed. If the primary tumor is unilateral, neck dissection is done on the involved side, in anticipation of ultimate cervical node metastasis which has been found to occur in roughly 50% of the cases. When the hypopharyngeal tumor is essentially a midline lesion and no palpable nodes are found, the neck dissection is delayed until appearance of a node, at which time neck dissection is carried out on the affected side.

Reconstructive methods are completely reported as used satisfactorily in 10 patients.

STEELE, Kansas City, Kan.

TRANSORAL INTRALARYNGEAL APPROACH FOR ARYTENOIDECTOMY IN BILATERAL VOCAL CORD PARALYSIS WITH INADEQUATE AIRWAY. WILLIAM C. THORNELL, Ann. Otol. Rhin. & Laryng. 66:364 (June) 1957.

A brief review of the etiology and clinical features of bilateral vocal cord paralysis is presented. The technique of transoral intralaryngeal arytenoidectomy is outlined in detail, together with items of importance in postoperative care. The author reports successful results in 55 out of 56 cases. In order to afford a more adequate airway, arytenoidectomy on the opposite side was necessary in seven patients.

STEELE, Kansas City, Kan.

PEMPHIGUS OF THE LARYNX. G. OBREGON, Ann. Otol. Rhin. & Laryng. 66:649 (Sept.) 1957.

The author reports two cases of laryngeal pemphigus, describing diagnosis and treatment in detail. It is emphasized that pemphigus frequently appears first in the larynx, later involving the body surface or more accessible areas of the respiratory and digestive tracts. Therefore, this disease, while of rare occurrence, should be important to the laryngologist.

Two tests of value in the early diagnosis of the disease, before the appearance of skin lesions, are the Tzanck and Cantharides tests.

The Tzanck test is performed on the fluid obtained from a vesicle. A smear is made and processed in the same manner as a routine blood smear, using Giemsa's stain. The finding of acantholytic or Tzanck cells, showing rounded, sharply defined and deeply staining cytoplasm with rounded, swollen, and hyperchromatic nuclei is diagnostic.

The Cantharides test consists of placing a small amount of Cantharides cerate N. F., measuring 4×4×2 mm., under an elastic bandage on the skin of the forearm. The bandage is left in place for three hours, after which an excision biopsy of the resulting bulla is done and the wound closed. The specimen is fixed in formalin and stained with hematoxylin-eosin for microscopic study. Again, the finding of acantholytic cells is diagnostic.

STEELE, Kansas City, Kan.

AVOIDING INJURY TO THE EXTRALARYNGEAL NERVES. RALPH L. GREGG, Ann. Otol. Rhin. & Laryng. 66:656 (Sept.) 1957.

While many workers have called attention to extralaryngeal branching of the recurrent laryngeal nerves and their relations to the inferior thyroid artery, certain practical aspects of the immense amount of past study must emerge.

First, it is the opinion of the author, that it really does not matter how often the recurrent nerve passes in front, behind, or between the branches of the inferior thyroid artery. The important point is that, in the main, the nerve can be found in this location rather readily.

Secondly, it does not matter that the nerves vary somewhat when the right side is compared to the left. Nor is it of real concern that the nerve branches within the "danger zone" of the thyroid space, provided this fact is recognized and an effort is made to visualize both branches. The infrequent number of times the recurrent nerve branches into several instead of two branches is of little concern if none is injured.

Lastly, on the average, the nerve can be easily found. It usually remains as one trunk, or at most, two branches and can be dissected free without much technical difficulty. Direct visualization of the recurrent laryngeal nerves during thyroid surgery is strongly recommended. It is the belief of Gregg that the time and energy required to develop an operative technique which consistently avoids injury to the extralaryngeal nerves is well worth the effort.

Recurrent laryngeal nerve trunk paralysis (paralysis of abductor and adductor muscles), either unilateral or bilateral, makes up the greatest percentage of cases of laryngeal paralysis. Pure bilateral abductor paralysis is rare and an immediate surgical emergency. Pure adductor paralysis is not an emergency but seriously affects the patient's voice so long as it exists.

STEELE, Kansas City, Kan.

TREATMENT OF PAPILLOMA OF THE LARYNX. F. C. W. CAPPS, Ann. Otol. Rhin. & Laryng. 66:926 (Dec.) 1957.

As yet, no specific therapy for papilloma of the larynx has appeared. Perhaps some form of chemotherapy or antibiotic therapy for the virus or viruses which may be responsible for the disease will ultimately replace present-day surgical procedures. Until such therapy is practical, however, the following list of "don'ts" compiled by Dingley, the author's colleague, will serve as guideposts in the treatment of laryngeal papillomata:

"1. Don't attempt to give a child with a larynx full of papilloma a good voice; you will be very likely to give such a case a permanently bad adult voice.

2. Don't do both sides at one sitting.

3. Don't do more than pluck off the protruding papillomata.

4. If there are small papillomata on both cords up to the anterior commissure, leave this critical area alone.

5. All treatment should have one aim—don't damage the larynx."

STEELE, Kansas City, Kan.

THE ETIOLOGY OF PAPILLOMA OF THE LARYNX. JO ONO, HIDEO SAITO, MAKOTO IGARASHI, and MAKOTO ITO, Ann. Otol. Rhin. & Laryng. 66:1119 (Dec.) 1957.

Laryngeal papilloma is conditioned by various factors rather than caused by them, which illustrates the formula: "Intrinsic factors plus extrinsic factors equals neoplasm." That a virus is the most likely causative agent is pointed out. Tissue culture, chick embryo and animal and human inoculations of papilloma tissue were performed in a study of the etiology of this disease.

STEELE, Kansas City, Kan.

ABDUCTOR PARALYSIS IN THEORY AND PRACTICE SINCE SEMON. F. C. W. CAPPS, J. Laryng. & Otol. 72:1-31 (Jan.) 1958.

The Semon Lecture for 1957 was delivered by Capps, who talked on "abductor paralysis" in theory and practice since Semon. This excellent, comprehensive article comments on the statement made by Semon that "in all progressive organic lesions of the centres or trunks of motor laryngeal nerves the abductors of the vocal cords succumb much earlier than the adductors." A diversity of opinion still exists relative to this statement. Experimental works of and reports by laryngologists are quoted freely, and the anatomy and functions of the superior and recurrent laryngeal nerves are discussed. The causes of unilateral and bilateral

abductor paralysis are reviewed, and the methods of treatment considered. This is an excellent and informative article on a controversial subject.

LEJEUNE, New Orleans.

MAJOR SURGERY OF THE LARYNX UNDER INDUCED HYPOTHERMIA. R. W. BAILIE, A. K. BOYLE, and A. MACIEJEWSKI, J. Laryng. & Otol. 72:558-570 (July) 1958.

Bailie, Boyle, and Maciejewski report their experiences with induced hypothermia in five patients having major surgical procedures on the larynx. The procedure considered for induced hypothermia was pharyngolaryngeal resection with block dissection as required and one-stage reconstruction when possible. Preoperative assessment was necessary in each patient. The technique of anesthetization is well described. Use of hypothermia in these five patients was highly successful. Recovery from anesthesia and restoration of protective reflexes were rapid, and postoperative vomiting did not occur. However, these authors point out the dangers of induced hypothermia. Nevertheless, they have been impressed by the excellent condition of the patients, during and after the extensive operations performed.

LEJEUNE, New Orleans.

PROBLEMS ASSOCIATED WITH TRACHEOTOMY. DANIEL C. BAKER, New York J. Med. 58:2656 (Aug. 15) 1958.

Baker is on the ENT Staff of Presbyterian Hospital, New York, and a surgeon in Delafield.

He also is a consultant in many local hospitals in New York and New Jersey. His wide experiences in World War II also qualify him to speak with authority concerning tracheotomy. This paper was read before the Annual Meeting of the New York State Medical Society in New York City, May 15, 1958.

The author says that more and more tracheotomies are now being done by more and more physicians of varying specialties than ever before. And so the time is ripe for a reappraisal of indications, methods, and management. Indications are (1) fixed obstruction of the upper airway; (2) fluid obstruction of the lower airway; (3) prevention of these two obstructions. Under (1) are congenital anomalies of larynx and trachea, trauma, infectious diseases, tumors, foreign bodies, and paralyses of the larynx; under (2) obstructions by secretions, neurologic conditions, poliomyelitis, tetanus, debilitating diseases, coma. Surgical specialties come to grips sooner or later with conditions which require tracheotomy. In these days, the laryngologist is likely to be called in *after* tracheotomy has been performed. It is then that after-care and management are best carried out by "the throat man."

Position at operation is a matter for decision when the patient is being readied. Supine is usually demanded, but the half-sitting, half-lying position may be best. One may have to juggle with the factors at hand before obtaining the optimum for breathing and comfort. The surgeon may open the trachea at the patient's bedside or elsewhere if the operating room is not readily available. Oxygen by mask or catheter is of value to the patient. A general anesthetic may be passed through an endotracheal tube. It is well to have an anesthetist at hand if possible. Local anesthesia is usually sufficient. Or, in an unconscious patient (cyanosis) no anesthesia is necessary.

In some cases the bronchoscope should not be used because there is danger of a false passage or perforation, especially in small children with an infection. Attempts to pass a needle into the trachea may result in emphysema of the neck and mediastinum. Bleeding into the trachea must be avoided. Preoperative sedation is dangerous to the respiratory center. Xylocaine, 1% or 2% with a few drops of Adrenalin, 1:100,000 can be used for skin and the deeper tissues. Baker does not allow Pontocaine or cocaine during tracheotomy in the operating room. The transverse incision is preferred to the vertical in most cases, but the exact middle of the trachea must be kept in view at all times. The thyroid isthmus must be exactly located and tied off in two places, and cut between them. All "bleeders" must be clamped and tied before splitting the tracheal rings. In children the rings are soft and sometimes deceptive, but one can enter the trachea between them. In adults the surgeon may excise a portion of a ring. To make sure the trachea is under one's fingers, a needle should be inserted in the midline to withdraw air. If blood is in the barrel, the needle was not in the lumen, but outside it.

The kind of tracheotomy tube must be chosen with care. Holinger has devised a series in different lengths and sizes. Plastic tubes are useful if x-ray therapy is to be given, but they

are unreliable. As soon as convenient, one should have x-ray studies made to show the position of the tube in relation to its surroundings.

Suitable after-care is of the essence of good management. If tracheotomy fails to relieve the obstruction, then we do not have a complete diagnosis. In any case the tube should be cleaned daily after the first two or three days. There will be secretion and crusts. These obstruct the airway. A 0.1% solution of sodium lauryl sulfate helps to discourage crusting. Cultures should be taken from the trachea, and appropriate antibiotics administered. Parents or others at home must be taught how to care for the tube. This may be done during the final week in the hospital when the parent can do the daily "dressing" under watchful supervision.

It is hoped that the tube can be removed in a few days and not replaced. Tests will be made by corking the lumen to see if the natural airway is sufficient. If the tube must be worn for months or years, one can expect stenoses. Keloids may form. Such adverse conditions require great skill in management.

ABSTRACTER'S COMMENT: This is a carefully studied presentation of a most important subject. Tracheotomy in adults is usually quite simple, and save for malignancies it seldom requires prolonged indwelling tubage. In children, the problems are often baffling and persistent throughout months and years. In adults, local anesthesia is entirely satisfactory. Before opening the trachea, a few drops of anesthetic into the lumen will give the "tranquil tracheotomy" of our British colleagues. Otherwise a geyser of secretions will blind the surgeon and attendants. In no case should peroxide be used. It can be immediately fatal. Internal use of the iodides may help to alter the stickiness of the secretions which form obstructing crusts.

Tracheotomy is often a life-saving procedure. It should be done as early as possible if increasing dyspnea is at hand. Procrastination can cause loss of life. The operating room is the proper place to open the trachea. One may have to do it in an ambulance or on the kitchen table!

I. W. VOORHEES, New York.

ICTUS LARYNGIS AND PHARYNGIS. A. LASKIEWICZ, Acta oto-laryng. 49:221 (May-June) 1958.

Ictus laryngis is a type of protective laryngeal reflex appearing in two forms. The mild form comprises itching and soreness in the throat combined with paroxysmal cough and strengthened inspiration. The serious form combines these with weakness and a short period of unconsciousness. There is an associated spasm of the cricopharyngeus. Manipulation of the larynx could cause the reflex. Etiology is considered due to hypersensitivity of the laryngeal nerves and/or the bulbar centers. Also, diabetes, asthmatic fits, and arthritic changes are factors. A similar situation may prevail with glossopharyngeal neuritis. Various body movements such as mastication, swallowing, and yawning, as well as sudden turning of the head, may precipitate attacks. Ictus pharyngis should be regarded as a reflex from the carotid sinus to the glomus caroticum, involving depressor and vasomotor adrenergic reactions.

LEWY, Chicago.

HISTOCYTOLOGICAL MALIGNANCY AND CLINICAL PICTURE IN EPIDERMOID CANCER OF THE LARYNX. ILMARI MULTANEN, Acta oto-laryng., Supp. 135, 1958.

This work composes a detailed study of 62 cases of carcinoma of the larynx removed using the thyrotomy approach. Each was serially sectioned and microscopically examined. A sample was taken from the anterior, middle, and posterior parts of each tumor. Malignancy was evaluated by Broder's system. Records were made of mitotic frequency and of each mitotic phase separately. These findings were compared with the clinical picture. Clinically considered were metastasis, recurrence, rate of tumor growth and clinical extension, age of patient, and survival time. Ventricular-fold cancer was dealt with as a separate problem. Treatment received minimal but essential attention.

In 12 cases the histological malignancy varied in different parts of the tumor. The cytological picture also differed in these cases; pathological divisions were equally divided in the interior of the tumor and at the periphery. Mean frequencies of prophases, metaphases, and mitosis were found to be lower in the posterior part of the tumor. This decrease in cytological activity of the posterior portion may relate to the fact that carcinoma seldom originates in this area.

As the histological malignancy increased there was an increase in the metaphase stages, pathological divisions, and the mitotic frequency. Corresponding prophase frequencies, however, diminished.

Carcinoma of the larynx is generally a disease of old people. However, that occurring in the relatively young showed a higher mean mitotic frequency. On other cytological data the groups did not differ. Since in older tumors the mitotic frequency, prophase index, and frequency of pathological divisions were less marked than in the younger tumors, they were considered cytologically less malignant. No quantitative conclusions could be drawn regarding the effect of inflammatory cells on the cancer of the larynx.

In comparing these data with a group of 14 benign papillomas of the larynx, the differences were of interest. In the papilloma group pathological divisions were extremely rare, mitotic frequency considerably lower. The prophase index was low. Interestingly, with respect to the later phases of mitosis, no differences were noted between cancer and benign papilloma.

On the basis of this study, the author concludes that the more malignant a tumor the more accelerated the spindle mechanism in its cells as compared with the intrachromosomal system. Also, except for mitosis, pathological divisions can be accounted for by this theory. However, the spindle mechanism of individual cells may on occasion be exceptionally retarded.

LEWY, Chicago.

Nose

THE CHOANAL POLYP. GUERDAN HARDY, Ann. Otol. Rhin. & Laryng. 66:306 (June) 1957.

The choanal polyp, nearly always of inflammatory type, originates in a paranasal sinus, usually the maxillary, is unilateral and solitary, and is not associated with other polypoid changes in the nose. Radical external sinus surgery for removal of the polyp, its attachment and diseased sinus mucosa is the procedure of choice, although reviews of the literature indicate that good results may be expected in 80% of patients without chronic sinusitis after simple removal by snare. Careful selection of candidates is therefore important.

STEELE, Kansas City, Kan.

TRENDS IN RADICAL FRONTAL SINUS SURGERY. ROBERT L. GOODALE, Ann. Otol. Rhin. & Laryng. 66:369 (June) 1957.

Proper antibiotic treatment, where normal drainage from the sinus is established, has shifted many cases previously considered amenable only to radical frontal sinus surgery to the more conservative procedures. When normal drainage from the sinus cannot be established, early external trephine is performed in the acute cases.

Where external operation is necessary, the nasofrontal duct is left intact, out of deference to the physiologic importance of the cilia, if the sinus is expected to return to normal function.

Goodale states that the rationale of the external combined frontoethmoid operation is open to question because of the likelihood of nasofrontal duct occlusion and the tendency to reinfection. For the chronic cases, total obliteration is gaining favor, either by the total ablation technique of Kuhnt, Ropke, or Riedel followed by reconstruction of the supraorbital contour by autogenous bone grafts, or the osteoplastic flap and tissue, blood clot or gelatin foam implant technique of Tato and Bergara. The osteoplastic flap is accomplished by connecting a series of trephine holes at or just inside the borders of the anterior wall of the frontal sinus, then prying downward so as to obtain a linear fracture of the thin sinus floor. Diseased mucosa is completely removed, except for the region of the nasofrontal duct, the mucosa of which is turned in a cuff and invaginated into the nose. The sinus cavity is then filled by fascia lata, abdominal aponeurosis, blood clot, or Gelfoam and the anterior wall flap replaced.

STEELE, Kansas City, Kan.

THE ANALYSIS OF VASCULAR REACTIONS IN THE NASAL MUCOSA WITH THE PHOTOELECTRIC PLETHYSMOGRAPH. DARRELL L. DAVIS, and ALRICK B. HERTZMAN, Ann. Otol. Rhin. & Laryng. 66:622 (Sept.) 1957.

The authors studied variations in the rate of arterial perfusion and in the degree of hyperemia as applied to the nasal septal mucosa. The photoelectric plethysmograph demonstrated a fair degree of accuracy in recording changes in blood content in the tissues studied. The technique of conducting the reported studies is presented in detail.

Compared with observations previously made on the finger pad, the changes in septal blood content appeared to be relatively and absolutely larger when various vasomotor responses were elicited. These differences were attributed to the participation in the reactions by the relatively extensive venous plexus of the septum. The rate of septal blood flow appears to be of the

same order of magnitude as that in the finger pad. This is inferred from the amplitude of the volume pulse and the estimated rate of septal heat loss.

STEELE, Kansas City, Kan.

CANCER OF THE MAXILLARY ANTRUM. EDGAR R. FRAZELL, New York J. Med. 58:1547 (May 1) 1958.

Malignancy usually arises from the maxillary mucous membrane and is squamous or epidermoid in character. However, sarcoma, lymphosarcoma, and osteogenetic tumors are seen now and then. Delay in diagnosis is due to x-ray report of "cloudy antrum," since pus or thick bone will cast a deep shadow, and one may diagnose an acute or chronic sinusitis. Erosion of the bony walls comes late, and metastatic lymph nodes likewise. Surgery must be "radical," including the clearance of the orbit when and if the superior maxilla is resected. Radiation after operation is the rule.

ABSTRACTER'S COMMENT: In at least a few cases, cancer invades the antrum from a site in the temporomandibular space or other area. I remember a patient who complained of blocking of the Eustachian tube while on vacation in Florida. The otologist inflated, of course, but nothing was said of the sinuses. Three weeks later in New York I did a Caldwell-Luc operation and was surprised to find carcinoma with partial destruction of the posterior wall and probable invasion of the base of the skull. Radium needles after operation brought some improvement. The case then left my hands for deep x-ray radiation. The woman died within a few days from "general acidosis"(?).

I. W. VOORHEES, New York.

THE SELECTION OF PATIENTS FOR RHINOPLASTY. J. B. ERICH, Surg. Gynec. & Obst. 106:481 (April) 1958.

Attention is directed to the increased emphasis upon cosmetic plastic surgery in newspapers and periodicals for lay consumption, and the statement is made that more and more people are becoming conscious of congenital and acquired defects involving the nose.

The author stresses that those people requesting cosmetic nasal operations should be considered in two groups: those who will benefit by this type of surgery and those on whom a plastic surgeon should refuse to operate. Those in the first group are usually quite pleased with a successful rhinoplasty, while those in the second category are often beset by mental and emotional problems which are not in any way altered by the surgery. In fact, these patients are often left "disgruntled, disturbed and dissatisfied" with every phase of the rhinoplastic procedure. A fairly critical appraisal of personality thus becomes a prerequisite to cosmetic nasal plastic surgery. Shattered romances, disillusionment in marriage, and unsatisfactory social adaptation are not solved by altering nasal contour.

Countless persons have been made happy by nasal plastic procedures. Persons who expect a rhinoplasty to do anything more than alter the shape of the nose should be discouraged from having this type of cosmetic surgery.

FRIEDBERG, Chicago.

Pharynx

CANCER OF THE TONGUE. DANIEL CATLIN, New York J. Med. 58:2703 (Aug. 15) 1958.

This is another in the series of radio talks for the practitioner over WNYC-FM under the general caption "Cancer Alerts," and sponsored by the New York Cancer Committee (No. 11).

Catlin states: "This neoplasm causes more deaths than any other tumor arising in the head and neck." It comprises about 15% of all such, and about 2% to 3% of all body cancers. The mean age is 58, and males are the chief sufferers. The edge of the middle third is the usual locus (50%); one-third is at the base, the remainder at the tip. Chronic irritation is supposedly a contributing cause; most of the patients have bad teeth, diseased gums, and poor mouth hygiene. A differential must be made regarding syphilis, chronic glossitis, and leukoplakia. The last is always under suspicion for prodromal cancer. Tobacco, pipe smoking, is still under investigation as a cause. The epidermoid type is found in 90%; 10% are adenocarcinoma; sarcoma is rare.

Diagnosis of cancer might be suspected by the patient when he finds with his finger a hard spot which seems to be growing. If a gland is affected in the neck, metastasis has already begun—some 35% of patients will have it at the first examination by a physician. Hence the importance of educating the public in this matter.

Treatment is surgical, by x-ray, or by radium. Operative mortality is less than 1%, but the base of the tongue is not favorable for surgery. Nodes in the neck call for block dissection with removal of the sternomastoid, internal jugular vein and the contents of the submaxillary triangle, with all lymphatics, nodes, etc. Radiation therapy is commonly in use for inoperable cases. If one is lucky enough to have a patient with a lesion 2 cm. or less in diameter, without metastases, the hope for a "cure" over a five-year period is a sanguine one. In all other cases, early and advanced, the hope of having 30% alive after five years may be a vanishing one.

ABSTRACTER'S COMMENT: The rhinolaryngologist does not see these patients early enough. We like to think we do not miss any, since we are "alerted" for cancer in our daily routine. Biopsy will always be done, with a request for immediate report. There is never any time to lose. The surgery is not too difficult. Tying off the external carotid should probably be routine procedure, since vascularity is likely to be greater than normal, and bleeding at any operation is the *bête noire* of every surgeon. Frequent postoperative examinations are imperative.

I. W. VOORHEES, New York.

MULTICENTRIC CARCINOMAS OF THE ORAL CAVITY. C. G. MOERTEL and E. L. FOSS, Surg. Gynec. & Obst. 106:652 (June) 1958.

Of 732 patients with proved oral cancer seen at the Mayo Clinic during the 10-year period from 1944 through 1953, a total of 64, or 8.7%, were found to have two or more discrete oral cancers.

Associated leukoplakia was found in 75% of the patients with multiple oral lesions. An overwhelming majority of the patients were users of tobacco, particularly in the forms which expose the mouth to tobacco juices.

The tendency to multicentricity shown by patients with oral cancer also extends to involve the contiguous squamous epithelium of the lips, pharynx, larynx, and esophagus. Fifty-five patients with oral carcinoma were found to have additional primary lesions in these locations, thus raising the over-all occurrence rate of multicentricity to 16.4%.

When oral cancer develops, all of the contiguous squamous mucous membrane must be considered as highly susceptible to future malignant change. It is the responsibility of the physician to insist on frequent and regular follow-up examinations so that any second lesion may be detected and treated in its early stages. It is also his responsibility to initiate appropriate prophylactic measures to eliminate any possible sources of carcinogenic irritation to these regions.

AUTHORS' SUMMARY.

Miscellaneous

RESPIRATORY DISTRESS IN INFANCY. ALFRED E. DIAB, and CEASAR N. ABU-JAUDEH, Ann. Otol. Rhin. & Laryng. 66:198 (March) 1957.

The authors enumerate the causes of respiratory distress in infants located above the larynx as bilateral imperforate nares, stenosis or web of the anterior nares, posterior choanal atresia, septal abscess, Pierre Robin syndrome (glossoptosis, micrognathia, and cleft palate), nasopharyngeal tumors, thyroglossal cyst, lingual thyroid, congenital cysts of the base of the tongue.

The causes of respiratory distress located in the larynx are congenital laryngeal stridor, congenital laryngeal web or atresia, congenital subglottic stenosis, anomalies of the cricoid cartilage, congenital laryngeal cysts and tumors, trauma, vocal cord paralysis resulting from intracranial damage or pathologic states present at birth. Below the laryngeal level one may find anomalies of the trachea, cervical compression of the trachea by dermoid cysts, cystic hygroma, thyroid cysts, aberrant thyroid tissue or branchial cysts, vascular mediastinal abnormalities, bronchial and pulmonic abnormalities. Included in this last group of causes of respiratory distress are pulmonary agenesis, cardiac and vascular anomalies, bronchogenic cysts and diverticulae, bronchoesophageal fistula, bronchopleural fistula, and cystic pulmonic change due to staphylococcic pneumonia.

Rare causes of respiratory distress are idiopathic emphysema (lobar), atelectasis of the newborn, diaphragmatic hernia, bronchiolitis and congenital dysphagia due to cerebral agenesis, Riley-Day syndrome, familial bulbar paralysis, and amyotonia congenita.

STEELE, Kansas City, Kan.

COLLAGEN DISORDERS OF THE RESPIRATORY TRACT. SIR VICTOR NEGUS, Ann. Otol. Rhin. & Laryng. 66:699 (Sept.) 1957.

In a discussion of collagen disorders, Negus states that an increase or swelling of collagen will reduce the powers of dilatation and contraction of bronchi, bronchioles, and alveoli, with resultant emphysema and dyspnea, as evidenced by asthma. Temporary swelling of these fibers may also produce reversible effects.

It has been found that collagen fibers will swell by absorption of water to about 50%; in dilute acids or alkalis as much as 4,500%. It is known that the pH of nasal tissue fluid may rise to as high as 8.5 in allergic states. Presumably, similar changes occur in the bronchial tissues. A resulting increased permeability of cell walls increases the intracellular and intercellular fluid which bathes the collagen fibers. This factor, associated with increased alkalinity causes swelling of collagen fibers during asthmatic attacks. The bronchiolar and bronchial lumina are narrowed, owing to mucosal edema and resistance of the swollen collagen fibers to expansion and contraction during respiration which results in dyspnea. Permanent hypertrophic and inflammatory changes produce emphysema and other signs of obstruction.

The author suggests that efforts to correct increased cellular permeability by overproduction of mucus is poorly directed, because, first of all, it is in the tissues themselves that damage to collagen occurs while the mucoid covering is confined to the mucosal surface, and, secondly, the viscosity of the mucus is increased. This tenacious blanket is anchored to the contents of the goblet cells, which have proliferated greatly with a consequent excess in quantity of mucus, and as the number and efficiency of the ciliated cells is reduced, there is stagnation of viscid secretion. Blockage of the bronchial lumen and impaired ventilation result.

Benefit from the use of the corticosteroids in such conditions appears to depend upon the two factors of increased antibody production and decreased cellular permeability. It is believed that prednisone should be superior to cortisone for this purpose. If the reaction of the tissue fluids and permeability of cell walls are reduced, with diminished reactive swelling of collagen, then abnormal reactive production of mucus is no longer required and relief to the asthmatic patient may be expected.

STEELE, Kansas City, Kan.

WHIPLASH INJURY OF THE NECK: SYMPTOMS, DIAGNOSIS, TREATMENT AND PROGNOSIS. MURRAY M. BRAAF and SAMUEL ROSNER, New York J. Med. 58:1501 (May 1) 1958.

This is in a sense "a new disease." It is purely traumatic in origin and occurs when one auto hits another from the rear—what the Insurance companies call a "same direction accident." The driver is thrown suddenly forward, then backward, causing trauma to the spinal column and the nerves and muscles related thereto. It seems that every part of the body can become involved, and there is likely to be also a psychoneurotic element. EENT symptoms include lacrimation, photophobia, hemianopsia, diplopia, twitching of the eyelids, and pain in and around the eyes. The nose, throat, and ears may be disturbed: rhinorrhea, clogging of one or both nares, loss of smell or taste or both, epistaxis, etc. In the ears, deafness may follow this peculiar injury (usually temporary), tinnitus, vertigo, auralgia, etc. In the throat there may be pain, hoarseness, dryness, yawning, and dysphagia. In the thorax there may be disturbances of respiration, cough, wheezing, precordial pain, rapid or slow heart, deep sighing, and other symptoms. The pain may simulate angina pectoris or coronary disease. Treatment is through sedatives, control of pain by whatever seems best, and physiotherapy. Heat may bring some relief, usually temporary. These authors have found traction to be the most helpful; cervical traction in the supine position relieved some 80% wholly or partially. Some 10% had "satisfactory relief."

ABSTRACTER'S COMMENT: As EENT specialists we can do very little in such cases save to give some temporary relief. We need to know the traumatic background.

I. W. VOORHEES, New York.

ALLERGIC REACTIONS TO VACCINES. SAMUEL UNTRACHT, New York J. Med. 58:1724 (May 15) 1958.

This is a critical review of reactions to vaccines now in use for active immunizations. While profound undesired reactions are rare, an occasional case may become very disturbing. Hazards seen in the young, the aged, and the debilitated require special consideration. The pregnant woman, exposed to poliomyelitis and influenza, who is potentially allergic, may give cause for concern. One may find fever, malaise, nausea, and vomiting. The author sets up

three groups: bacterial, viral and rickettsial. Vaccination against pertussis often gives reactions, but these are rarely of consequence. Against typhoid, owing to restless migrations of peoples across continents, one should employ "booster injections as a routine procedure." Catarrhal vaccines are still *sub judice*. Some physicians think them of great value; others disregard their potentiality against "colds." BCG inoculations seem to have no ill effects. They are useful in tuberculosis cases and may offer increased resistance to other invaders as well. Toxoid reactions may be quite severe when used in scarlet fever, diphtheria, and against tetanus. Allergy to viral and rickettsial vaccines is found against yellow fever, Rocky Mountain spotted fever, etc. These may be severe. Inoculations against influenza virus "may have serious consequences." It may be well to give small doses frequently rather than large doses at greater intervals. Antirabic vaccines require rather special knowledge based on experience.

Smallpox is, of course, the classic and basic instance of protection against a virus. The "take" is sometimes quite severe and disturbing to the patient, but it is well to explain to him his need for just this showing, and that the procedure may be life-saving for him.

In summary, a history of any previous allergic reaction should be noted, and if it was severe, one must proceed with caution. There is a hazard from chick-egg-propagated vaccine in some cases, but this can be estimated by a very small intradermal dose (0.1 cc.) as a try-out. Any history of specific reaction to eggs or meat, in the history, should alert the physician to a lurking hazard.

Two tables and 71 references make this contribution of great value for the understanding and application of this valuable means of building up the human body against unseen enemies. Viral diseases seem to be growing in number and potentiality; therefore, every physician is under an obligation to try to understand them, whatever his specialty.

I. W. VOORHEES, New York.

RESPIRATORY OBSTRUCTION. BELLEVUE HOSPITAL CONFERENCE. New York J. Med. 58:1731 (May 15) 1958.

This report was prepared by the Anesthesia Study Committee of the New York State Society of Anesthesiologists sitting in conference at Bellevue Hospital on Feb. 3, 1958. It concerns the history of an 82-year-old woman who was operated upon for a fractured head of the right femur. Apparently she died from obstruction caused by an endotracheal cuff which became dislodged and obstructed the tracheal lumen. The following observations were made: "Whenever one cannot be certain why an endotracheal tube does not provide a clear airway, it is wise to consider removal of the tube." In this instance the cuff had been torn and had lodged in the lumen of the tube, thus cutting off the air. Certain rules should be followed: 1. Ascertain the proper position of the tube. 2. Make sure of its patency. A suction catheter passed down through the tube will help to determine this fact. Secretions will be sucked out; mechanical closure will persist. Usually expiration is chiefly interfered with. Increasing tachycardia and arterial hypertension will be present. The blood is dark and the respirations labored. 3. See that the tube is of proper size and length. A small-diameter tube may be easier to insert, but may kink or misbehave otherwise. If the tube is too narrow or too long, it is well to discard it for a more suitable one. This is No. 41 of a series of Clinical Anesthesia Conferences. Four references to the literature are set down.

I. W. VOORHEES, New York.

CANCER OF THE ESOPHAGUS. JOHN H. GARLOCK, New York J. Med. 58:1741 (May 15) 1958.

This is No. VI in the series "Cancer Alerts" broadcast over Station WNYC under the auspices of the New York Academy of Medicine and the New York City Cancer Committee. . . . Garlock says that the past sixteen years have changed our thought in the therapeutic approach to this dread disease. Early symptoms are dysphagia, and localized burning when hot food is ingested. One should avoid any reference to "nervous manifestations." These do exist to be sure, but may entirely becloud the real issue. The direct tube examination is paramount in spite of dread of perforation, annoyance to the patient, et cetera. If a biopsy can be done, the diagnosis can be promptly determined and surgery undertaken before it is too late. . . . Our present position is encouraging because of marked progress in methods of anesthesia; better understood pathology of diseases of the chest; development of new operative procedures; preoperative care as to vitamin, electrolyte, and fluid imbalances; thorough postoperative care; antibiotics. . . . Operative mortality is under 15%. It is possible to remove part or even all

of the stomach, and to attach the severed ends, even to drawing the distal portion way up into the thorax. A five-year "cure" is now almost the rule. Again the surgical tenet must be emphasized: Early diagnosis and immediate operation are imperative to success.

I. W. VOORHEES, New York.

THREE CASES OF PERIPHERAL FACIAL PALSY OF UNUSUAL ORIGIN. E. P. G. DE DIOS, Acta oto-rino-laring. iber-amer. 9:13, 1958.

Three interesting cases of facial palsy are presented. The first is that of a 7-year-old boy who developed an acute tonsillitis. A few days later he noticed some difficulty in swallowing food and fluids, at times a return of the fluids through his nose, a difficulty in turning his head, and a paralysis of the left side of his face. The diagnosis was postdiphtheritic polyneuritis, which cleared up under treatment of strychnine, calcium and vitamin B_1.

The second case was that of a 44-year-old man who had a transient facial paralysis in 1936, which cleared up in a few days. In 1947 he had a bilateral otitis media, which lasted four months. In 1956 he developed a complete left-sided facial paralysis, apparently "a frigore." However, there was x-ray evidence of pathology in the right mastoid. A radical mastoidectomy was performed, and a small cholesteatoma was found which had eroded a small area of the facial canal. The facial nerve was decompressed for about 5 mm. The patient made an almost complete recovery.

The third case was that of a 24-year-old woman who developed a facial paralysis three months after a radical mastoidectomy. This was proved to be a typical Bell's palsy due to refrigeration.

PERSKY, Philadelphia.

LARYNGOLOGY: A RETROSPECT, A REVIEW AND A REVALUATION. R. J. CANN, Proc. Roy. Soc. Med. 51:205 (March) 1958.

Mr. Cann is president of the Section of Laryngology. This is his address before that body on Nov. 1, 1957. The Section he heads is now 50 years old, and therefore it is a good time to take account of stock. The story goes back to 1893, when Sir Felix Semon founded the London Laryngological Society. Semon went to London in 1875 with an introduction to Sir Morell Mackenzie, who founded the "Metropolitan Free Dispensary for Diseases of the Throat and Loss of Voice," said to be the first of its kind in the world, now better known as the Golden Square Hospital. Mackenzie had studied with Czermak in Pest, and had learned how to use the laryngoscope. Here history seems in need of correction; Garcia is commonly given credit for this invention (his name is not even mentioned in Cann's sketch). Czermak borrowed the laryngeal mirror from Prof. Türck of Vienna. The sun was the source of light at first, but its vagaries led to the adaptation of artificial light. Czermak is given credit for the origin of our specialty, and the date is set at November, 1857. What were those early specialists like? First of all they were general physicians, and "did everything." They had no electric light, no knowledge of bacteria, no x-rays, and until 1880, no cocaine, no adrenalin. . . . To see a larynx one had to train the patient to relax the throat and *not gag*! This must have required oceans of time and patience. Most needed instruments had to be invented. (This writer (I. W. V.) remembers the old "duckbill-shaped" laryngeal forceps of Mackenzie, and the difficulty of removing growths from the larynx, even under cocaine after 1907). . . . Mackenzie developed such great skill and knowledge that he could write a book—two volumes of some 500 pages each, which became and remained "standard" for years. It was so well thought of, Semon translated it into German. Sir Henry Butlin at St. Bartholomew's was persuaded to add laryngology to his general surgery, against his will, or so it seems. Other pioneers were D. R. Paterson, of Cardiff, and Watson-Williams, of Bristol. Otology seems to have been already well set, and laryngology was added because it was so well within the compass of head and neck work. Both were surgical specialties from the beginning, but have become less and less so with advancing years, and since the antibiotics and chemotherapy came into vogue. Cann refers to the "noninfective" disorders of the nose and sinuses, and stresses the need for preservation of cilia, so often destroyed by surgery. Now we speak more of allergy and psychosomatic conditions. We use less surgery, which may be wise or perhaps too conservative, depending on the case at hand.

Cann was early in the field of endoscopy, and it was the removal of foreign bodies which gave impetus to this branch of N-T. Then he and his coterie began to do more and more work

in the esophagus with diagnosis of malignancy from observation and biopsy. He says: "In my opinion we should limit endoscopy to the neck." He will have plenty of opposition to this, one may be sure. Atrophic rhinitis had almost disappeared, and tuberculosis and syphilis are seldom seen these days in the larynx. Also, "I find in all sections of the community an increasing decline in the numbers of patients needing tonsillectomy or operations on the nasal sinuses." The advances in general are the use of cocaine, endoscopy, antibiotics, and radiation. ". . . The quota of surgery is almost gone from the life of a laryngologist." He hints that we are all headed back toward the time-honored status of general practitioners.

I. W. VOORHEES, New York.

News and Comment

ANNOUNCEMENTS

Central Illinois Society of Ophthalmology and Otolaryngology.—The newly elected officers of the Central Illinois Society of Ophthalmology and Otolaryngology are as follows:

President: William F. Hubble, M.D., Decatur, Ill.

President-Elect: Charles D. Sneller, M.D., Peoria, Ill.

Vice-President: Edgar T. Blair, M.D., Springfield, Ill.

Delegate at Large: G. Leroy Porter, M.D., Urbana, Ill.

Secretary-Treasurer: Clarence A. Fleischli, M.D., 520 E. Allen St., Springfield, Ill.

The spring meeting of the Society will be a joint meeting with the Indiana Academy of Ophthalmology and Otolaryngology in French Lick, Ind., April 24, 25, and 26, 1959. The fall meeting will be in Decatur, Sept. 25 and 26, 1959.

Books

BOOKS RECEIVED

* **Die Rhinogenen Erkrankungen der Orbita,** Part 2. By Dr. Med. R. Herrmann. Price, $4.30. Pp. 83, with 42 illustrations. Georg Thieme Verlag, Herdweg 63, Stuttgart (14a). (In the U. S. A. and Canada, Intercontinental Medical Book Corporation, 381 Fourth Ave., New York 16), 1958.

Ciba Foundation Colloquia on Ageing, Volume 4: Water and Electrolyte Metabolism in Relation to Age and Sex. Edited by G. E. W. Wolstenholme, O.B.E., M.A., M.B., B.Ch., and Cecilia M. O'Connor, B.Sc. Price, $8.50. Pp. 327, with many charts, tables, and diagrams. Little, Brown & Company, Medical Book Department, 34 Beacon St., Boston 6. Published in London by J. & A. Churchill, Ltd., 104 Gloucester Place, Portman Sq., London, W.1, 1958.

Ciba Foundation Symposium: Neurological Basis of Behaviour. Edited by G. E. W. Wolstenholme, O.B.E., M.A., M.B., B.Ch., and Cecilia M. O'Connor, B.Sc. Price, $9.00. Pp. 400, with charts, diagrams, and other illustrations. Little, Brown & Company, Medical Book Department, 34 Beacon St., Boston 6. Published in London by J. & A. Churchill, Ltd., 104 Gloucester Place, Portman Sq., London W.1, 1958.

BOOK REVIEWS

Hearing Therapy for Children. Second Edition. By Alice Streng, M.A.; Waring J. Fitch, M.A.; LeRoy D. Hedgecock, Ph.D.; James W. Phillips, M.D., and James A. Carrell, Ph.D. Price, $6.75. Pp. 353. Grune & Stratton, Inc., 381 Fourth Ave., New York 16, 1958.

This second edition is an excellent primer for all who are interested in the problems of hearing therapy for handicapped children. There is a logical presentation of the problems of deafness in children, their causes, the importance and methods of audiometry, hearing aids, and methods of education of the mild, moderate, and severe loss of hearing. The role of the parent, school teacher, the specially trained tutor, the psychologist, and the sociologist, is stressed. The needs and methods of teaching lipreading and the proper training and education of the child in the use of the hearing aid are presented in great detail. Speech therapy is elaborated and coordinated with lipreading.

The book is presented in a very simple form that is easily understood not only by the profession but also by the lay personnel. It is of extreme interest to the audiologist, pediatrician, school teacher, special tutors in audiology, speech therapist, psychologist, sociologist, and parents of these handicapped children.

* will be reviewed

Directory of Otolaryngological Societies *

FOREIGN AND INTERNATIONAL

Canadian Otolaryngological Society

(Société Canadienne d'Otolaryngologie)

President: Dr. Robert T. Hayes, 42 Cobourg St., St. John, N. B.
Secretary: Dr. Donald M. MacRae, 34 Spring Garden Rd., Halifax, N. S.

Venezuela Otorhinolaryngology Society

President: Dr. Alfredo Celis Pérez.
Secretary: Dr. Jesús Miralles.

International Association of Allergology

President: Dr. Samuel M. Feinberg, 303 E. Chicago Ave., Chicago 11.
Secretary-General: Dr. José Quintero Fossas, Paseo 313, Vedado, Havana, Cuba.

International Bronchoesophagological Society

President: Dr. Jo Ono, Tokyo.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Meeting: Eighth International Congress of Bronchoesophagology, Mexico City, March, 1959.

International College of Surgeons, Section of Ophthalmology and Otolaryngology

President: Dr. E. G. Gill, 711 S. Jefferson St., Roanoke, Va.
Secretary-Treasurer: Dr. Louis Savitt, 3403 W. Lawrence Ave., Chicago 25.

International Congress of Audiology

General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Netherlands.
Place: Leyden, Netherlands.

International Course in Paedo-Audiology

General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Netherlands.
Place: Groningen, Netherlands.

Mexican Society of Otolaryngology

President: Dr. Rafael Giorgana
Secretary: Dr. Carlos Valenzuela, Monterrey 47-201, Mexico 7, D. F.

Pan-American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

President: Dr. Paul H. Holinger, Chicago.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Meeting: Seventh Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology, Miami, March, 1960.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Victor R. Alfaro, Washington, D. C.
Secretary: Dr. Walter E. Heck, San Francisco.
Meeting: Atlantic City, June 8-12, 1959.

American Academy of Ophthalmology and Otolaryngology

President: Dr. LeRoy A. Schall, 243 Charles St., Boston.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

American Board of Otolaryngology

President: Dr. Gordon D. Hoople, 1100 E. Genesee St., Syracuse 10, N. Y.
Secretary-Treasurer: Dr. Dean M. Lierle, University Hospitals, Iowa City.

American Bróncho-Esophagological Association

President: Dr. Francis W. Davison, Geisinger Memorial Hospital, Danville, Pa.
Secretary: Dr. F. Johnson Putney, 1712 Locust St., Philadelphia 3.
Place: The Homestead, Hot Springs, Va. Time: March 10-11, 1959 (afternoon only).

American Laryngological Association

President: Dr. Fred W. Dixon, 2060 E. 9th St., Cleveland.
Secretary: Dr. James H. Maxwell, University Hospital, Ann Arbor, Mich.
Place: The Homestead, Hot Springs, Va. Time: March 8-9, 1959.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Gordon D. Hoople, 1100 E. Genesee St., Syracuse 10, N. Y.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: The Homestead, Hot Springs, Va. Time: March 10-12, 1959 (mornings only).

SECTIONS:

Eastern.—Chairman: Dr. Joseph L. Goldman, New York.
Place: The Savoy Plaza, New York. Time: Jan. 8-9, 1959.
Southern.—Chairman: Dr. James T. King, Atlanta, Ga.
Place: Hotel-Atlanta Biltmore, Atlanta, Ga. Time: Jan. 23-24, 1959.
Middle.—Chairman: Dr. Alfred J. Cone, St. Louis, Mo.
Place: Park Plaza Hotel, St. Louis. Time: Jan. 12-13, 1959.
Western.—Chairman: Dr. Robert C. McNaught, San Francisco, Calif.
Place: The Ahwahnee Hotel, Yosemite Valley, Calif. Time: Jan. 17-18, 1959.

American Rhinologic Society

President: Dr. Russell I. Williams, 408 Hynds Bldg., Cheyenne, Wyo.
Secretary: Dr. Robert M. Hansen, 1735 N. Wheeler Ave., Portland, Ore.

American Otological Society, Inc.

President: Dr. Moses H. Lurie, 483 Beacon St., Boston.
Secretary: Dr. Lawrence R. Boies, University Hospitals, Minneapolis 14.
Place: The Homestead, Hot Springs, Va. Time: March 13-14, 1959.

American Otorhinologic Society for Plastic Surgery, Inc.

President: Dr. Armand L. Caron, 36 Pleasant St., Worcester, Mass.
Secretary: Dr. Joseph G. Gilbert, 75 Barberry Lane, Roslyn Heights, N. Y.

American Society of Facial Plastic Surgery

President: Dr. Trent W. Smith, 327 E. State St., Columbus 15, Ohio.
Secretary: Dr. Samuel M. Bloom, 123 E. 83rd St., New York 28.
Meetings: March 18 and July 15, 1959, New York.

American Society of Ophthalmologic and Otolaryngologic Allergy

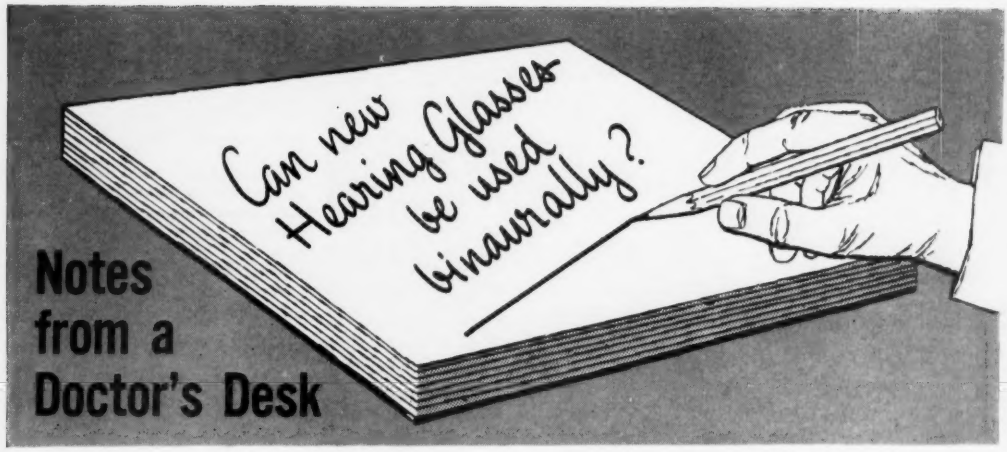
President: Dr. Joseph W. Hampsey, Grant Building, Pittsburgh 19.
Secretary-Treasurer: Dr. Daniel S. DeStio, 121 S. Highland Ave., Pittsburgh 6.

Otosclerosis Study Group

President: Dr. E. P. Fowler Jr., 180 Fort Washington Ave., New York 32.
Secretary-Treasurer: Dr. Arthur L. Juers, 1018 Brown Building, Louisville 2.

Society of Military Otolaryngologists

President: Lt. Col. Stanley H. Bear (MC), USAF, Maxwell AFB, Ala.
Secretary-Treasurer: Capt. Maurice Schiff (MC), U. S. N., U. S. Naval Hospital, Oakland, Calif.



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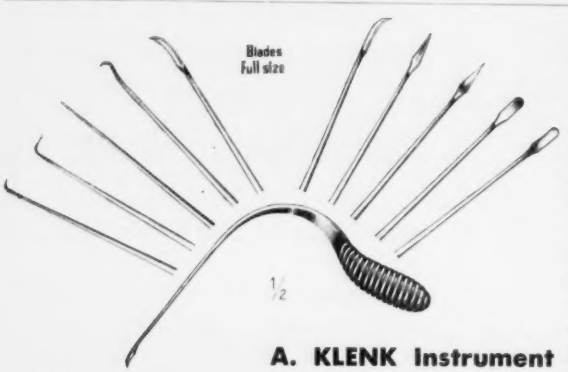

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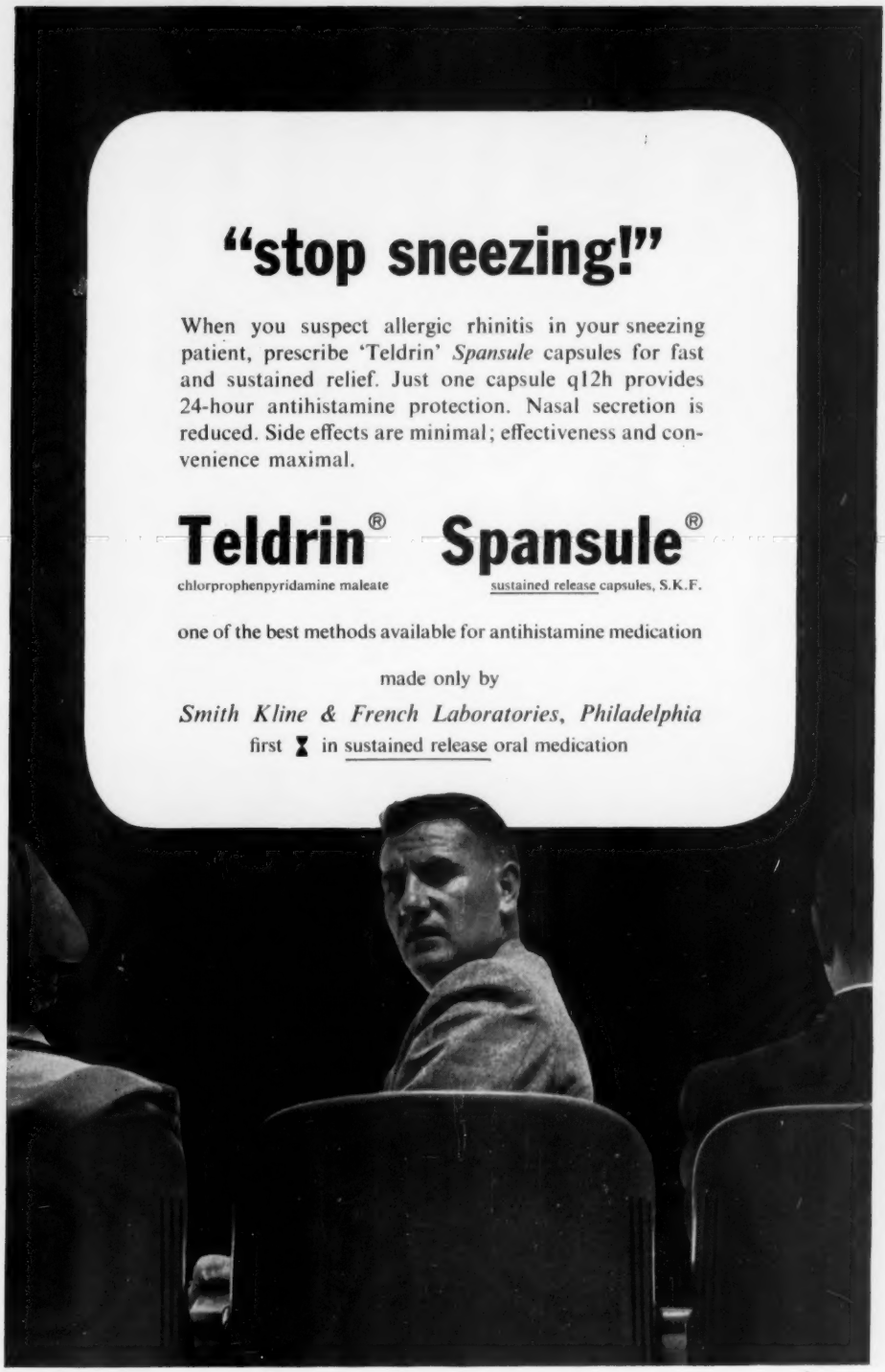
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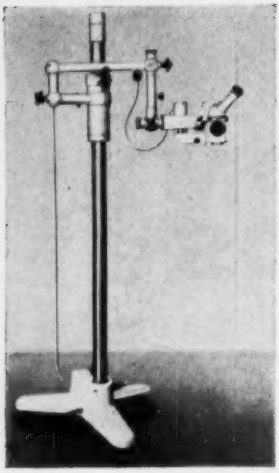

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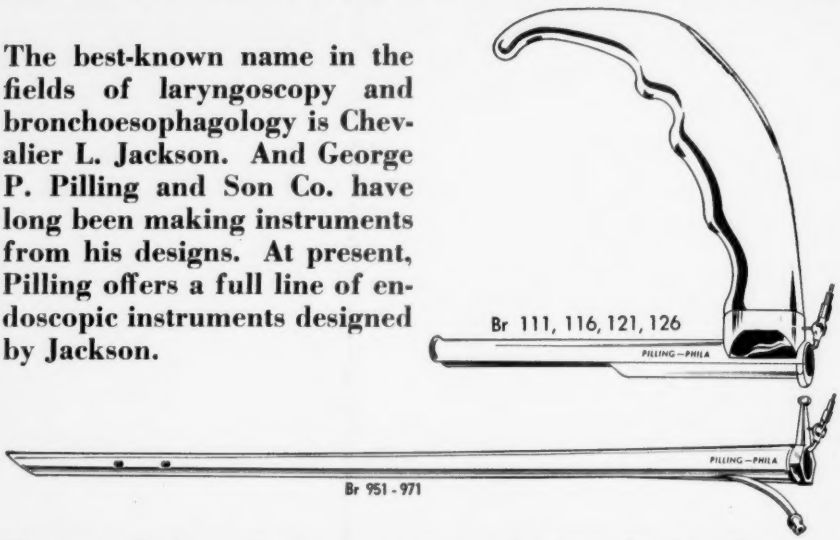

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